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THE
PRACTICE OF PHARMACY

A TREATISE

ON THE MODES OF MAKING AND DISPENSING OFFICIAL,
UNOFFICIAL, AND EXTEMPORANEOUS PREPARATIONS,
WITH DESCRIPTIONS OF MEDICINAL SUBSTANCES, THEIR
PROPERTIES, USES, AND DOSES

INTENDED AS

A HAND-BOOK FOR PHARMACISTS AND PHYSICIANS

AND

A TEXT-BOOK FOR STUDENTS

SIXTH EDITION
VOL. II

BY

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WITH OVER EIGHT HUNDRED ILLUSTRATIONS

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PREFACE TO THE SIXTH EDITION SECOND VOLUME

THE remarkable growth of Remington's Practice of Pharmacy convinced the author that it might be divided, for the sake of the student in the college, into two volumes—the first volume for students of the first year, and the second volume for second-year students. The books would not have to be carried to and fro from lecture rooms when not needed and yet the student would own the whole book.

The present volume is the second volume of the Sixth Edition of the Practice of Pharmacy, and should be studied in connection with Volume I, Sixth Edition. Volume II is a continuation of the same subject, Volume I being furnished with a separate preface and index.

The whole book in *one volume* is being furnished by the publishers.

The author is indebted to many helpers. A. Hastings Fitzkee, P.D., a graduate of the Philadelphia College of Pharmacy in 1916, assisted in preparing copy and reading proof. Dr. A. Parker Hitchens was invited by Prof. E. F. Cook to pass the articles on animal products.

The difficulties in completing this book on account of a foreign war have been very great and caused much delay, but no pains have been spared to make it as complete as possible, and great credit must be given the publishers for their unflagging industry in doing the mechanical part of the work.

J. P. R.

PHILADELPHIA, October, 1917.

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PART III

INORGANIC SUBSTANCES

INTRODUCTORY

THE various operations and processes which are used in the practice of pharmacy having been treated of in their general relations to one another in the preceding chapters, it is now necessary to consider in detail the physical and chemical properties of the substances that enter into the preparations which are used in medicine.

The plan which will be followed presupposes on the part of the student a knowledge of elementary chemistry, and hence chemical physics, nomenclature, the theoretical construction of formulæ, etc., will not be entered into. The great number of valuable text-books on chemistry, now accessible to every student, renders the introduction of even brief articles on these subjects unnecessary, and the space will be reserved for the consideration of the chemical substances of the materia medica from a pharmaceutical standpoint. For reasons which need not be entered into here, the latest (and to some extent conflicting) views of modern chemists upon the classification of these substances are not adopted, but a method is employed which, while it does not do violence to the accepted theories, is simple and practical. The substances are grouped together according to their physical or therapeutical properties, while their supposed chemical analogies have not been entirely overlooked. This plan has the merit of giving the student a different view of the chemical substances from that to which he is accustomed in his study of chemistry, and will, perhaps, enhance the interest and impress the points of difference in the substances more forcibly upon the mind.

As an illustration, the chemical properties of such non-metallic elements as Hydrogen, Oxygen, and Nitrogen will not be noticed at length; they are not recognized articles of the materia medica in their free state; but the acids, bases, and salts containing them are largely used, and they form substances which can be advantageously grouped together for profitable study by the pharmacist.

The table which follows gives the symbols and atomic weights of the elements; those which are of special interest from a pharmaceutical point of view are distinguished from the rest by being printed in heavier type.

Atomic Weights

Adopted by the International Committee on Atomic Weights (1915)

Oxygen = 16

Name.	Symbol.	Atomic Weight.
Aluminum	Al	27.1
Antimony	Sb	120.2
Argon	A	39.88
Arsenic	As	74.96
Barium	Ba	137.37
Bismuth	Bi	208.0
Boron	B	11.0
Bromine	Br	79.92
Cadmium	Cd	112.40
Cæsium	Cs	132.81
Calcium	Ca	40.07
Carbon	C	12.00
Cerium	Ce	140.25
Chlorine	Cl	35.46
Chromium	Cr	52.0
Cobalt	Co	58.97
Columbium	Cb	93.5
Copper	Cu	63.57
Dysprosium	Dy	162.5
Erbium	Er	167.7
Europium	Eu	152.0
Fluorine	F	19.0
Gadolinium	Gd	157.3
Gallium	Ga	69.9
Germanium	Ge	72.5
Glucinum	Gl	9.1
Gold	Au	197.2
Helium	He	3.99
Holmium	Ho	163.5
Hydrogen	H	1.008
Indium	In	114.8
Iodine	I	126.92
Iridium	Ir	193.1
Iron	Fe	55.84
Krypton	Kr	82.92
Lanthanum	La	139.0
Lead	Pb	207.10
Lithium	Li	6.94
Lutecium	Lu	174.0
Magnesium	Mg	24.32
Manganese	Mn	54.93
Mercury	Hg	200.6
Molybdenum	Mo	96.0
Neodymium	Nd	144.3
Neon	Ne	20.2
Nickel	Ni	58.68
Niton (radium emanation)	Nt	222.4
Nitrogen	N	14.01
Osmium	Os	190.9
Oxygen	O	16.00
Palladium	Pd	106.7
Phosphorus	P	31.04
Platinum	Pt	195.2
Potassium	K	39.10
Praseodymium	Pr	140.6
Radium	Ra	226.4
Rhodium	Rh	102.9
Rubidium	Rb	85.45
Ruthenium	Ru	101.7
Samarium	Sa	150.4
Scandium	Sc	44.1
Selenium	Se	79.2
Silicon	Si	28.3
Silver	Ag	107.88
Sodium	Na	23.00
Strontium	Sr	87.63
Sulphur	S	32.07
Tantalum	Ta	181.5
Tellurium	Te	127.5
Terbium	Tb	159.2
Thallium	Tl	204.0
Thorium	Th	232.4
Thulium	Tm	168.5
Tin	Sn	119.0
Titanium	Ti	48.1
Tungsten	W	184.0
Uranium	U	238.5
Vanadium	V	51.0
Xenon	Xe	130.2
Ytterbium (Neoytterbium)	Yb	172.0
Yttrium	Yt	89.0
Zinc	Zn	65.37
Zirconium	Zr	90.6

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CHAPTER XXXII

HYDROGEN, OXYGEN, WATER, AND NITROGEN

H; 1.008. O; 16.00. H_2O; 18.016. N; 14.01.

Hydrogen is a colorless, inodorous, and combustible gas; it is the lightest of all substances. Chemically, it is one of the most important and interesting of the elements, and it was used as unity for many years in fixing the atomic weights of other elements. However, oxygen at 16.00 has now been generally adopted as the basis for atomic weights, thus making hydrogen 1.008, the change being made chiefly because, with oxygen as the basis, a larger number of the elements became whole numbers. Pharmaceutically, in its uncombined state, it is of very little importance, and the reader is referred, for further information, to the chemical text-books.

Oxygen, as usually seen, is a colorless, inodorous gas which aids combustion; it is the most abundant of the elements, forming about one-fifth of the total weight of our atmosphere. Water contains nearly ninety per cent. by weight of oxygen, and it is present in varying quantities in most vegetable and animal substances. The compounds which it forms with other bodies are termed oxides: these are of great pharmaceutical interest, and they will be considered hereafter under their appropriate heads. Oxygen in its free, gaseous condition is frequently used medicinally and is now official. It is chiefly supplied compressed in cylinders.

Nitrogen is a colorless, tasteless and odorless gas of a density slightly less than air. In the free state it constitutes about four-fifths of the atmosphere and shows little activity towards other elements. Many of its compounds, however, are intensely active, such as the alkaloids, cyanides, etc. Nitrogen itself has little pharmaceutical interest, but many of its compounds are official.

OXYGENIUM. U. S. **Oxygen**
[Oxygen.]

It contains not less than 95 per cent. by volume of O (16). For convenience it is usually compressed in metal cylinders.

Preparation.—It is prepared by a continuous process wherein barium oxide, BaO, is heated in porcelain tubes, in a current of air, to 500° C. (932° F.), when it takes up oxygen, forming barium dioxide, BaO_2. When the heat is increased to 800° C. (1472° F.), BaO is again formed and oxygen liberated. If now cooled to 500° C. (932° F.) oxygen is recombined and again freed at the higher temperature. In time the barium must be renewed, as it loses its power of absorbing oxygen. The most important method, and one which is extensively employed, includes the liquefying of air and the subsequent evaporation of the nitrogen.

Official Description.—A colorless gas.

Odor and Taste.—Odorless and tasteless.

Test for Identity.—It supports combustion more readily than air; a glowing splinter of wood held in the gas bursts into flame.

Solubility.—One volume of Oxygen dissolves in about 34 volumes of water and in about 3.6 volumes of alcohol at 25° C. (77° F.).

Impurities and Tests for Impurities.—*Carbon Dioxide.*—Pass 2000 mils of Oxygen, measured under normal atmospheric pressure at about 25° C. (77° F.), at a rate not exceeding 4000 mils per hour, through 100 mils of barium hydroxide T.S.; not more than an opalescent turbidity is produced.

Halogens.—Pass 2000 mils of Oxygen, under the conditions described above, through a mixture of distilled water and 1 mil of silver nitrate T.S.; no opalescence is produced.

Acids or Bases.—Pass 2000 mils of Oxygen through 100 mils of distilled water, colored with a few drops of litmus T.S., under the conditions described above; the color of the liquid is not changed.

Assay.—Mix about 50 mils of Oxygen, accurately measured in a calibrated tube, with 10 mils of alkaline pyrogallol T.S.; not less than 95 per cent. by volume is absorbed, corresponding to not less than 95 per cent. by volume of O.

Uses.—Medicinally, it is used in grave cases of sickness to supply sufficient oxygen to the blood or to prevent cyanosis during the administration of anesthetics. It is sold in cast-steel cylinders, under about 120 to 130 atmospheres pressure, and when used the pressure is regulated by a special attachment. It is also largely used industrially in the oxy-hydrogen or oxy-acetylene blow-pipe for welding platinum, cutting structural iron work, etc., in oxidizing oils in varnish manufacture and in many other industrial operations.

AQUA. U. S. Water

$H_2O = 18.016$

Water is the most important and useful compound known to the pharmacist: its molecule, H_2O, is composed of two parts of hydrogen and one part of oxygen.

The purity of water is specified in the official description, which is as follows:

Official Description.—A colorless, limpid liquid.

Odor, Taste, and Reaction.—Practically tasteless and odorless. When heated nearly to the boiling point and agitated, no disagreeable odor is evolved; neutral to litmus.

Impurities and Tests for Impurities.—*Solids.*—Evaporate 100 mils of Water in a platinum dish; it leaves a residue weighing not more than 0.03 Gm.

Organic Impurities.—The residue from the preceding test, when carefully heated to redness, evolves no visible fumes and shows no appreciable charring.

Mix 100 mils of Water with 10 mils of diluted sulphuric acid in a clean porcelain dish and heat it rapidly to boiling, then add 0.4 mil of tenth-normal potassium permanganate V.S. and boil the liquid for ten minutes; the color of the liquid is not completely destroyed (oxygen consuming capacity as a measure of *organic impurities*).

Lead or Copper.—Add 1 mil of hydrochloric acid to 100 mils of Water and then add 50 mils of hydrogen sulphide T.S.; it shows no darkening after standing fifteen minutes.

Iron.—Add 1 mil of hydrochloric acid to 100 mils of Water and then add 1 mil of potassium ferrocyanide T.S.; no blue coloration is produced immediately.

Chloride.—Add 0.5 mil of tenth-normal silver nitrate V.S. to 200 mils of Water, heat to boiling, filter and add to the filtrate 3 drops of potassium chromate T.S.; a red precipitate is produced.

Nitrite.—Add 1 drop of hydrochloric acid, 1 mil of sulphanilic acid T.S. and 1 mil of naphthylamine hydrochloride T.S. to 100 mils of Water in a Nessler jar, stirring with a glass rod after each addition. Closely cover the jar with a glass plate, place it upon a white surface and view it from above; no pink coloration appears within five minutes.

Nitrate.—Add 1 mil of sodium carbonate T.S. to 100 mils of Water and evaporate the liquid in a small porcelain dish just to dryness. Moisten the residue thoroughly with 2 mils of phenolsulphonic acid T.S., gently warm the dish, add 20 mils of ammonia water and sufficient distilled water to measure 100 mils. Any yellow color produced is not greater than that obtained by evaporating 0.0021 Gm. of potassium nitrate, dissolved in 3 mils of distilled water and 1 mil of sodium carbonate T.S., to dryness and treating the residue in the same manner as the residue from the Water. The comparison of colors must be made in Nessler jars of the same diameter and size.

Ammonium Compounds.—Add 2 mils of alkaline mercuric potassium iodide T.S. to 100 mils of Water in a Nessler jar and mix thoroughly. Place the jar on a white surface and view the contents from above; the water does not at once assume a deep yellow or orange color.

Uses.—The powers and uses of water as a solvent have been already noted in the previous chapters. The United States Pharmacopœia directs water, under the name of Aqua, or distilled water, under the name of Aqua Destillata, to be used in the various processes according to the necessities of the occasion. Ordinary water always contains solid matter and traces of various salts in solution or suspension; these do not unfit it for drinking purposes, but would often seriously interfere with the purity of many chemical substances if such water were used in their preparation. The official processes err on the safe side, and direct distilled water in all cases where the use of ordinary water might be injurious or of doubtful propriety. In some sections of the country, the drinking water might be pure enough for the processes, or at least not contain serious impurities; in other sections the water would be totally unfit for the preparations. The purity of official distilled water is beyond question, and its use therefore removes all doubts.

AQUA DESTILLATA. U. S. Distilled Water

For process, see page 308. The official tests for the purity of distilled water are, of course, much more exacting than those for water (see below).

Official Description.—A colorless, limpid liquid.

Odor, Taste, and Reaction.—Without odor or taste; neutral to the U. S. P. indicators (see Chapter LXII).

Impurities and Tests for Impurities.—*Sulphate.*—Separate portions of 100 mils each of Distilled Water are not affected by the addition of barium chloride T.S. or

Chloride.—Silver nitrate T.S., or

Calcium.—Ammonium oxalate T.S., or

Metals.—Hydrogen sulphide T.S. or sodium sulphide T.S.

Ammonia.—It shows no deep yellow, orange or brown coloration when 1 mil of Nessler's reagent is added to 100 mils of the Water.

Carbon Dioxide.—Add 50 mils of calcium hydroxide T.S. to 25 mils of Distilled Water; the mixture remains clear and transparent.

Residue.—Evaporate 100 mils of Distilled Water to dryness on a water bath and subsequently dry the residue in an oven to constant weight at 100° C. (212° F.); not more than 0.001 Gm. of residue remains.

Organic or Other Oxidizable Substances.—Heat 100 mils of Distilled Water to boiling, acidulate it with 10 mils of diluted sulphuric acid, and subsequently add 0.1 mil of tenth-normal potassium permanganate V.S. The color of the liquid is not completely destroyed by boiling it for ten minutes.

Uses.—Distilled water is used in pharmacy principally as a solvent for delicate chemical salts, and for purposes for which ordinary water is unfitted (see page 653).

LIQUOR HYDROGENII DIOXIDI. U. S. Solution of Hydrogen Dioxide

[**Liq. Hydrog. Diox.**—AQUA HYDROGENII DIOXIDI, U. S. P. VIII SOLUTION OF HYDROGEN PEROXIDE]

An aqueous solution containing not less than 3 per cent. by weight of H_2O_2 (34.02), corresponding to not less than 10 volumes of available oxygen. Preserve it in a cool place protected from light. Upon removing the stopper from the bottle, not more than a slight pressure should be observed.

Preparation.—Solution of Hydrogen Dioxide is now made commercially on a large scale. The former official method of preparation consisted of decomposing barium dioxide with phosphoric acid and this process is yet used, the phosphoric acid being recovered from the barium phosphate through treatment with sulphuric acid, the recovered phosphoric acid being again employed for making the dioxide and the resulting barium sulphate sold for technical purposes.

$$\underset{\text{Barium Dioxide}}{BaO_2} + \underset{\text{Phosphoric Acid}}{2H_3PO_4} = \underset{\text{Barium Phosphate}}{Ba(H_2PO_4)_2} + \underset{\text{Hydrogen Dioxide}}{H_2O_2}$$

In this process any trace of barium salt in the solution of hydrogen dioxide, remaining after the decomposition, is removed by the cautious addition of sulphuric acid, which precipitates an insoluble barium sulphate.

Other methods, however, are also in use in which the phosphoric acid is replaced by sulphuric, oxalic, hydrochloric, or hydrofluoric acids. For economic reasons the first of these acids, sulphuric, has been most largely used, but, because of the heat developed in the reaction, very thorough refrigeration is required. Oxalic acid in small amount was sometimes added to the solution by manufacturers, thus fraudulently raising its indicated strength when assayed, but this is now detected by a special test.

Owing to the readiness with which this Solution ordinarily undergoes decomposition, many attempts have been made to render it more stable. Acetanilid is now generally used as a preservative and the Pharmacopœia permits this or other harmless preservatives, in amounts not exceeding 0.04 Gm. in each 100 mils. In solutions where acetanilid has been introduced, a bitter almond-like odor sometimes develops. This indicates decomposition. The U. S. P. Latin title has been changed to "Liquor Hydrogenii Dioxidi" instead of "Aqua" to bring the Latin and English titles into harmony.

Official Description.—A colorless liquid.

Odor, Taste, and Reaction.—Odorless or having an odor suggesting ozone, slightly acid to the taste; acid to litmus, producing a peculiar sensation and froth in the mouth; prone to deteriorate upon keeping or upon protracted agitation, and rapidly decomposed by contact with many oxidizing as well as reducing substances. If the stopper of the bottle is coated with paraffin or replaced by a pledget of purified cotton, deterioration is retarded.

Tests for Identity.—When exposed to the air at the ordinary temperature or when heated on a water bath at a temperature not exceeding 60° C. (140° F.), the solution loses chiefly water. When rapidly heated, it frequently decomposes suddenly.

Shake 1 mil of Solution of Hydrogen Dioxide with 10 mils of distilled water containing 1 drop of diluted sulphuric acid, and add 2 mils of ether. The subsequent addition of a drop of potassium dichromate T.S. produces a blue color in the aqueous layer. Upon agitation, this blue color passes into the ethereal layer.

Impurities and Tests for Impurities.—*Non-volatile Matter.*—Not more than 0.03 Gm. of solid residue remains on evaporating 20 mils of the Solution to dryness on a water bath.

Free Acid.—It requires not more than 2 mils of tenth-normal potassium hydroxide V.S., phenolphthalein T.S. being used as indicator, to neutralize 25 mils of Solution of Hydrogen Dioxide.

Arsenic.—Add 1 mil of ammonia water to 1 mil of the Solution and evaporate the liquid to dryness on a water bath; the residue meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Heavy Metals.—Evaporate 1 mil of the Solution to dryness on a water bath and dissolve the residue in 10 mils of distilled water containing 1 mil of diluted hydrochloric acid; the liquid does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Hydrofluoric Acid.—Evaporate 50 mils of the Solution, previously rendered alkaline by the addition of sodium hydroxide T.S., to dryness on a water bath and transfer the dry residue to a platinum crucible. Moisten the residue with sulphuric acid, and cover the crucible with a watch glass, the convex side of which is coated with a thin layer of wax which is afterwards scratched so as to expose the glass. Cool the watch glass by placing water in the concave side and standing in this a small beaker which must be kept filled with cold water. Now heat the crucible and contents on a water bath for one hour; the surface of the watch glass after being cleaned shows no sign of corrosion.

Barium.—The addition of 2 drops of diluted sulphuric acid to 10 mils of the Solution produces no turbidity or precipitate within ten minutes.

Oxalic Acid.—Add 4 drops of sodium acetate T.S. to 10 mils of the Solution and follow with 4 drops of calcium chloride T.S.; no turbidity or precipitate is produced within ten minutes.

Limit of Preservative.—Shake out 100 mils of Solution of Hydrogen Dioxide in a separator with a mixture of three volumes of chloroform and two volumes of ether, using 50 mils, 25 mils, and 25 mils, respectively, and evaporate the combined solutions to dryness at room temperature in a tared glass dish. A residue may be obtained which weighs not more than 0.04 Gm.

Assay.—Dilute about 2 Gm. of Solution of Hydrogen Dioxide, accurately weighed, with 20 mils of distilled water, then acidulate it with 20 mils of diluted sulphuric acid and titrate with tenth-normal potassium permanganate V.S. It shows not less than 3 per cent. of H_2O_2.

Each mil of tenth-normal potassium permanganate V.S. used corresponds to 0.0017008 Gm. of H_2O_2, or to 0.0008 Gm. of oxygen. Each gramme of Solution of Hydrogen Dioxide corresponds to not less than 17.6 mils of tenth-normal potassium permanganate V.S.

Uses.—Solution of hydrogen dioxide (or peroxide, as it is usually termed) is an energetic antiseptic and disinfectant; it is oxygenated water, another atom of oxygen being chemically combined; as found in commerce it is designated as a 100 vol., 30 vol., 15 vol., 10 vol., 8 vol. solution, etc., by which is meant a solution of the hydrogen dioxide which will yield 100 volumes, 30 volumes, 15 volumes, 10 volumes, or 8 volumes of active oxygen when used. The 100 volume, or 30 per cent. by weight solution, is being used medicinally under the name *perhydrol,* and is said to be less irritating than weaker solutions because of the absence of free acid. In this form it is relatively permanent, but when diluted with water rapidly deteriorates. Diluted solutions are employed as local applications and in inflammations of mucous membranes. Solution of Hydrogen Dioxide is probably free from poisonous properties. *Great care must be exercised to prevent decomposition; the bottles containing the solution must be kept in a cool place and the stopper may be coated with paraffin or replaced by a pledget of cotton as this retards decomposition.*

Average Dose.—1 fluidrachm (4 mils).

NITROGENII MONOXIDUM. U. S. Nitrogen Monoxide

[**Nitrogen. Monox.**—NITROUS OXIDE]

Nitrogen Monoxide gas [$N_2O = 44.02$]. For convenience in handling and use, it is compressed in metal cylinders.

Preparation.—It is usually prepared by heating ammonium nitrate to about 170° C. (338° F.), when the following reaction occurs:

$$\underset{\text{Ammonium Nitrate}}{NH_4NO_3} = \underset{\text{Nitrogen Monoxide}}{N_2O} + \underset{\text{Water}}{2H_2O}$$

Official Description.—A colorless gas.

Odor and Taste.—It has a slight characteristic odor and a somewhat sweet taste.

Tests for Identity.—It supports the combustion of many substances.

Solubility.—It is quite soluble in water at low temperatures; 1 volume of water dissolves about 1.3 volumes of nitrous oxide at 25° C. (77° F.).

Impurities and Tests for Impurities.—*Carbon Dioxide.*—Pass 2000 mils of the gas, measured under normal atmospheric pressure at about 25° C. (77° F.), through 100 mils of barium hydroxide T.S. at a rate not exceeding 4000 mils per hour; not more than a slight turbidity is produced.

Halogens.—No opalescence is produced in a mixture of 100 mils of distilled water and 1 mil of silver nitrate T.S. by 2000 mils of the gas under the conditions described above.

Acids or Bases.—No change in color is produced in 100 mils of distilled water to which 5 drops of litmus T.S. have been added, by the passage of 1000 mils of the gas through the liquid under the conditions described above.

Reducing Substances.—No alteration in color is produced in a solution of 0.2 mil of tenth-normal potassium permanganate V.S. in 100 mils of distilled water, by the passage of 1000 mils of the gas through the liquid under the conditions described above.

Uses.—This gas is largely used by inhalation when momentary anesthesia is desired, as by a dentist for the extraction of teeth. During its administration the patient often becomes hysterical and because of this characteristic it is often called *laughing gas.*

CHAPTER XXXIII

THE INORGANIC ACIDS

THE official inorganic acids form one of the most important classes of compounds used in pharmacy. They are distinguished from other bodies by the following properties: 1. They all contain hydrogen, and are sometimes called hydrogen salts. The hydrogen is capable of being replaced by metals. 2. They have a characteristic sour taste and corrosive action. 3. They act on litmus and other vegetable substances, changing their color.

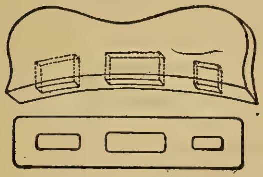
The official inorganic acids will be considered in the following order: 1. Those which do not contain oxygen or *hydracids,* and which are derived from non-metallic elements—*viz.*: Hydrochloric, Hydriodic, and Hydrobromic Acids. 2. The non-metallic oxygen acids—Nitric, Nitrohydrochloric, Sulphuric, Hypophosphorous, and Phosphoric Acids. 3. Arsenic Trioxide and Chromium Trioxide (formerly known as Arsenous and Chromic Acids) and the weak acid obtained from Boron, will not be treated as acids, but will be described under the headings of the elements from which they are formed.

The names of the acids which contain oxygen vary in their terminations like the salts of certain metals—the suffixes *ous* and *ic* being used, the former to denote the lower proportion of oxygen, the latter the higher. Thus sulphur*ous* acids, H_2SO_3, now among the reagents, contains less oxygen than sulphur*ic* acid, H_2SO_4; nitr*ous* acid, HNO_2, less than nitr*ic* acid, HNO_3, etc.

Practical Points in Handling Strong Acids.—The strong inorganic acids are never made by the pharmacist for commercial purposes, as they can be manufactured much more economically upon a large scale. They are corrosive in their action, and must be handled very cautiously to avoid personal injury. They are usually sent out by manufacturers in one pound, or in five pint, glass-stoppered bottles, or in carboys holding about ten gallons. One of the common annoyances is the liability of the glass stopper to become so tightly fastened in the neck of the bottle that it is extracted with difficulty. As this always happens with bottles which have well-fitting and hence most valuable stoppers, it becomes an object to extract the stopper without injury. This may frequently be done by grasping the bottle firmly, and, after cleaning off the lute, carefully tapping the stopper *gently* with the *wooden* handle of a pestle or spatula. If very moderate measures do not succeed, the stopper wrench (see Fig. 440) should be used. This is made of hard wood, of the shape shown in the cut, the lower cut giving the end view and showing the relative sizes of three holes in the wrench. These should be made somewhat larger than the stoppers of the bottles for which the wrench is likely to be used. The upper cut gives the side view of the wrench, which is shaped to fit the hand, and shows the relative depths of the holes. The refractory stopper is placed in the hole, and the operator grasps the wrench with the right hand and endeavors to twist the stopper out. If it does not yield to moderate treatment, the neck of the bottle may be cautiously heated by wrapping it in a cloth wet with hot water, or by means of a spirit-lamp or Bunsen burner with a low flame, passing the flame quickly around it several times so that it shall be uniformly heated. This will cause expansion of the neck, and if the right moment be seized, which is just before the outer surface of the stopper becomes correspondingly heated, the stopper may be easily extracted, the principle of action depending upon unequal expansion. If these means do not succeed, the bottle should be inverted in a vessel of warm water to a depth sufficient to cover the neck and allowed to remain several hours; if the wrench is then used, success is generally assured. Corks should not be used as stoppers for the strong acids, because of the corrosive action of the latter on them—a portion of the cork almost invariably contaminating and discoloring the acid.

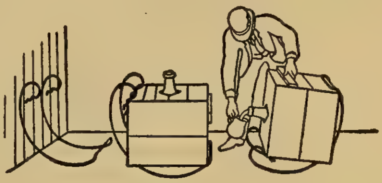
The handling of carboys containing strong acids is sometimes attended with difficulty and danger. The simplest method known to the author is by the use of Stevenson's carboy rocker (see Fig. 441).

Fig. 440



Stopper wrench

Fig. 441



Use of carboy rocker

This consists of a solid elastic steel rod bent into the shape shown in the cut. To place it in position, the carboy is tilted until it rests on a bottom corner; the closed end of the rocker is then pushed into place on the bottom edge, and the springs adjust themselves to the upper edge of the carboy. The latter can then be tilted easily and without spilling the contents. The last drop can be poured out readily.

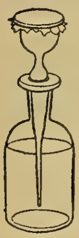
Quality of Commercial Acids.—Two grades of acids are found in commerce. The first is designated as C. P. (*chemically pure*), and this is the quality indicated by the U. S. Pharmacopœia to be used in making preparations and for tests, etc. The lower grade is sometimes known as *medicinally pure*, and is intended to be employed in the arts and for common uses.

Too much importance cannot be attached to the duty of securing pure and strong acids. The introduction of full and reliable tests in the Ninth Decennial Revision of the Pharmacopœia leaves the pharmacist without excuse if he neglects their careful examination. They are used in many of the qualitative and quantitative official tests. If the reagent used for testing is impure itself, the substance which is suspected and is being tested will fall under condemnation when it may be absolutely faultless. Then, again, loss and annoyance in making many preparations, like the iron salts and solutions, will surely follow the use of acids deficient in strength and purity.

Strength of the Official Acids.—The official inorganic acids are mostly solutions of gaseous acids in water, and no uniformity is to be found among them in the amount of water contained in the strong acids. For instance, hydrochloric acid contains from 31 to 33 per cent. of gaseous hydrochloric acid; nitric acid contains from 67 to 69 per cent. of gaseous nitric acid; and sulphuric acid contains from 93 to 95 per cent. of absolute sulphuric acid. On the other hand, the *diluted* acids are intended to be uniform—diluted hydriodic, hydrobromic, hydrochloric, hypophosphorous, phosphoric, and sulphuric acids each containing from 9.5 to 10.5 per cent. of the absolute acid.

Medical Properties.—The inorganic acids are generally tonic and refrigerant when administered in a diluted condition; externally, if applied undiluted, they are caustic and corrosive, and should be used with the greatest care. Brushes made of spun glass are sometimes employed to apply strong acids externally to ulcers. Test bottles with elongated stoppers, or the bottle shown in Fig. 442, are also advantageously used. One of the principal difficulties attendant upon the internal administration of acids is their injurious action upon the teeth. To avoid the destructive contact with the enamel, the diluted acid should be sucked through a narrow glass tube.

Fig. 442



Acid-dropper

Antidotes.—The strong acids are sometimes accidentally taken internally in poisonous doses; their corrosive action is rapidly manifested, and dangerous results may be justly apprehended. *Mild* alkalies in large doses should at once be administered in connection with some bland fixed oil. Lime liniment is usually upon the shelf already prepared, and valuable time may often be saved by at once giving it to the patient in large doses. Soap or sodium bicarbonate in dilute solution also may be given.

U. S. P. IX Inorganic Acids

Title	Sp. Gr. at 25° C. (77° F.)	Strength or Composition
Hydracids		
Acidum Hydriodicum Dilutum	about 1.100	from 9.5 to 10.5 per cent. HI
Hydrobromicum Dilutum	" 1.076	from 9.5 to 10.5 per cent. HBr
Hydrochloricum	" 1.155	from 31 to 33 per cent. HCl
Hydrochloricum Dilutum	" 1.049	from 9.5 to 10.5 per cent. HCl
Oxyacids		
Acidum Hypophosphorosum	" 1.130	from 30 to 32 per cent. HPH_2O_2
Hypophosphorosum Dilutum	" 1.042	from 9.5 to 10.5 per cent. HPH_2O_2
Nitricum	" 1.403	from 67 to 69 per cent. HNO_3
Nitrohydrochloricum	. . . . . .	18 mils Nitric Acid 82 mils Hydrochloric Acid
Nitrohydrochloricum Dilutum	. . . . . .	10 mils Nitric Acid 45.5 mils Hydrochloric Acid Distilled Water, enough to make 250 mils
Phosphoricum	about 1.72	from 85 to 88 per cent. H_3PO_4
Phosphoricum Dilutum	" 1.057	from 9.5 to 10.5 per cent. H_3PO_4
Sulphuricum	" 1.83	from 93 to 95 per cent. H_2SO_4
Sulphuricum Aromaticum	" 0.933	109 mils Sulphuric Acid 50 mils Tincture of Ginger 1 mil Oil of Cinnamon Alcohol, enough to make 1000 mils
Sulphuricum Dilutum	" 1.067	9.5 to 10.5 per cent. H_2SO_4

N. F. IV Inorganic Acid

Acidum Bromauricum	. . . .	represents 32 per cent. of gold (see Chapter XLVIII)

ACIDUM HYDROCHLORICUM. U. S. Hydrochloric Acid

[Acid. Hydrochl.]

An aqueous solution containing not less than 31 per cent. nor more than 33 per cent. of HCl (36.47). Preserve it in glass-stoppered bottles.

Preparation.—Hydrochloric acid, the only known compound of chlorine and hydrogen, is made on a very large scale both abroad and in this country. It is obtained as a by-product resulting from the manufacture of soda-ash, by decomposing common salt heated to a high temperature with sulphuric acid. By the Hargreave process a mixture of sodium chloride, sulphur dioxide, air and steam is heated to 500° C. (932° F.), reacting as follows:

$$\underset{\substack{\text{Sodium}\\\text{Chloride}}}{NaCl} + \underset{\substack{\text{Sulphur}\\\text{Dioxide}}}{SO_2} + \underset{\text{Oxygen}}{O} + \underset{\text{Water}}{H_2O} = \underset{\substack{\text{Sodium}\\\text{Sulphate}}}{Na_2SO_4} + \underset{\substack{\text{Hydrochloric}\\\text{Acid}}}{HCl}$$

By both processes sodium sulphate is formed, and gaseous hydrochloric acid is liberated. The latter is conducted into a tall tower filled with coke, called a coke scrubber; the ascending gas being met by a descending flow of water, which readily dissolves the gas. It is also a by-product in the electrolytic production of sodium hydroxide from sodium chloride. The liberated chlorine is heated with steam to 1000° C. (1832° F.), in the presence of an excess of carbon:

$$\underset{\text{Chlorine}}{Cl_2} + \underset{\text{Water}}{H_2O} + \underset{\text{Carbon}}{C} = \underset{\substack{\text{Hydrochloric}\\\text{Acid}}}{2HCl} + \underset{\substack{\text{Carbon}\\\text{Monoxide}}}{CO}$$

The sodium sulphate from the above processes is itself afterward used in the manufacture of sodium carbonate by the Leblanc process. When sulphuric acid is employed two steps are recognized. In this first reaction a relatively low temperature is used to heat the pan containing the mixture; the heat being obtained from the furnace gases. During this period but one-half of the sodium chloride reacts, as follows:

$$\underset{\substack{\text{Sodium}\\\text{Chloride}}}{2NaCl} + \underset{\substack{\text{Sulphuric}\\\text{Acid}}}{H_2SO_4} = \underset{\substack{\text{Hydrochloric}\\\text{Acid}}}{HCl} + \underset{\substack{\text{Sodium}\\\text{Chloride}}}{NaCl} + \underset{\substack{\text{Acid Sodium}\\\text{Sulphate}}}{NaHSO_4}$$

In the second step the mass is heated to redness by the direct action of the flame and yields the rest of the hydrochloric acid:

$$\underset{\substack{\text{Sodium}\\\text{Chloride}}}{NaCl} + \underset{\substack{\text{Acid Sodium}\\\text{Sulphate}}}{NaHSO_4} = \underset{\substack{\text{Hydrochloric}\\\text{Acid}}}{HCl} + \underset{\substack{\text{Sodium}\\\text{Sulphate}}}{Na_2SO_4}$$

The hydrochloric acid gas from the first reaction is purer than that obtained from the second, as the latter is mixed with the furnace gases. The product from each process is therefore separately led into batteries of earthenware jars, similar to Woulfe's bottles, containing water, and is there absorbed. Hydrochloric acid, or, more properly, solution of hydrochloric acid, is used to make the official preparations named and in the manufacture of chlorides and many other compounds. The yellow color of the common acid (*muriatic acid*) is generally due to organic substances or a trace of iron; the white fumes produced when the acid is exposed to the air are caused by the gaseous acid combining with the moisture in the air, and also with a trace of ammonia usually present, forming ammonium chloride.

Official Description.—A colorless, fuming liquid.

Odor, Taste, and Reaction.—Pungent odor; intensely acid taste; the fumes and odor disappear on diluting the Acid with 2 volumes of water; strongly acid to litmus, even when highly diluted.

Specific Gravity.—About 1.155 at 25° C. (77° F.).

Tests for Identity.—On distilling it at normal barometric pressure, a stronger acid passes over first, until, at 110° C. (230° F.), an acid of about 20 per cent. remains, which distils unchanged. When heated with manganese dioxide, it evolves chlorine.

Impurities and Tests for Impurities.—It conforms to the tests for identity and purity under *Acidum Hydrochloricum Dilutum* when diluted to that strength.

Assay.—Pour about 3 mils of Hydrochloric Acid into a tared bottle containing about 10 mils of distilled water, stopper, weigh accurately, dilute with 50 mils of distilled water and titrate the liquid with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows not less than 31 per cent. nor more than 33 per cent. of HCl.

Each mil of normal potassium hydroxide V.S. used corresponds to 0.03647 Gm. of HCl. Each gramme of Hydrochloric Acid corresponds to not less than 8.50 mils nor more than 9.05 mils of normal potassium hydroxide V.S.

U. S. P. Preparations.—Acidum Hydrochloricum Dilutum; Acidum Nitrohydrocholoricum; Acidum Nitrohydrochloricum Dilutum; Argenti Nitras Fusus; Extractum Ergotæ; Liquor Ferri Chloridi; Liquor Zinci Chloridi; Resina Podophylli; Sulphur Præcipitatum; Tinctura Sanguinariæ.

N. F. Preparations.—Elixir Pepsini; Fluidextractum Cinchonæ Aquosum; Glyceritum Pepsini; Liquor Chlori Compositus; Liquor Ferri Oxychloridi; Liquor Ferri Peptonati; Liquor Ferri Peptonati et Mangani; Liquor Ferri Protochloridi; Liquor Pepsini; Liquor Pepsini Aromaticus; Syrupus Calcii Hydrochlorophosphatis.

Uses.—Hydrochloric acid is largely used in making chlorides and other preparations. Medicinally it is usually prescribed in a diluted form. The dose is five to ten minims (0.3 to 0.6 mil).

ACIDUM HYDROCHLORICUM DILUTUM. U. S. Diluted Hydrochloric Acid

[Acid. Hydrochl. Dil.]

An aqueous solution containing not less than 9.5 per cent. nor more than 10.5 per cent. of HCl (36.47). Preserve it in glass-stoppered bottles.

	Metric	Old form
*Hydrochloric Acid	100 Gm.	4½ fl. oz.
Distilled Water	220 Gm.	11½ fl. oz.
To make	320 Gm.	16 fl. oz.

Mix them.

Official Description.—A colorless liquid.

Odor, Taste, and Reaction.—Odorless; strongly acid to the taste; strongly acid to litmus.

Specific Gravity.—About 1.049 at 25° C. (77° F.).

Tests for Identity.—With silver nitrate T.S. it yields a white, curdy precipitate, insoluble in nitric acid, but readily soluble in ammonia water.

Impurities and Tests for Impurities.—*Residue.*—Evaporate 25 mils of Diluted Hydrochloric Acid from a platinum or porcelain dish and dry at 110° C. (230° F.); not more than 0.003 Gm. of residue remains.

Bromide or Iodide.—Add 1 mil of chloroform to 10 mils of Diluted Hydrochloric Acid and then cautiously introduce chlorine water, which has been diluted with an equal volume of distilled water, a drop at a time, with constant agitation; the chloroform remains free from any yellow, orange or violet color.

Free Chlorine or Bromine.—Add 1 mil of potassium iodide T.S. and 1 mil of chloroform to 10 mils of Diluted Hydrochloric Acid and agitate the mixture; the chloroform remains free from any violet coloration.

Heavy Metals.—Two mils of Diluted Hydrochloric Acid, diluted with seven volumes of distilled water, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Five mils of Diluted Hydrochloric Acid diluted with 12 mils of distilled water (without the treatment with sulphuric and sulphurous acids) meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Sulphuric Acid or Sulphates.—Add 5 drops of barium chloride T.S. to a mixture of 3 mils of Diluted Hydrochloric Acid and 5 mils of distilled water; neither turbidity nor precipitation appears within one hour.

Sulphurous Acid.—At the end of the hour's standing, directed in the preceding test, the further addition to the liquid of 2 drops of tenth-normal iodine V.S. produces neither turbidity nor decoloration of the iodine.

Assay.—Pour about 10 mils of Diluted Hydrochloric Acid into a tared flask, weigh accurately, dilute with 30 mils of distilled water and titrate the liquid with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows not less than 9.5 per cent. nor more than 10.5 per cent. of HCl.

Each mil of normal potassium hydroxide V.S. used corresponds to 0.03647 Gm. of HCl. Each gramme of Diluted Hydrochloric Acid corresponds to not less than 2.6 mils nor more than 2.9 mils of normal potassium hydroxide V.S.

U. S. P. Preparation.—Liquor Acidi Arsenosi.

N. F. Preparations.—Extractum Conii; Liquor Pepsini Antisepticus.

Uses.—Diluted hydrochloric acid is used as a refrigerant and tonic in doses of fifteen to thirty minims (1 to 2 mils), largely diluted with water. It should be drawn through a glass tube or straw, to avoid injury to the teeth.

ACIDUM HYDROBROMICUM DILUTUM. U. S. Diluted Hydrobromic Acid

[Acid. Hydrobrom. Dil.]

An aqueous solution containing not less than 9.5 per cent. nor more than 10.5 per cent. of HBr (80.93). Preserve it in amber-colored, glass-stoppered bottles, protected from light.

Preparation.—Two methods are generally used for making this preparation—one by distillation, the other by double decomposition and precipitation. The former method yields the purer product, the latter is the more convenient. For other methods of preparation, see U. S. Dispensatory.

Diluted Hydrobromic Acid (Distillation Process).—Take of potassium bromide and sulphuric acid, each, 150 parts (by weight), distilled water, a sufficient quantity. Add the sulphuric acid to 25 parts of distilled water, and cool the mixture. Then dissolve the potassium bromide in 150 parts of water by the aid of heat, supplying the loss of water by evaporation during the heating. Carefully pour the diluted sulphuric acid into the hot solution with constant stirring, and set the mixture aside for twenty-four hours, in order that the acid potassium sulphate may crystallize. Pour off the liquid into a retort, break up the crystalline mass, transfer it to a funnel, and, having drained the crystals, drop slowly upon them 50 parts of cold distilled water so as to wash out the acid liquid. Add this liquid to that in the retort, and distil nearly to dryness at a moderate heat. If red fumes of bromine are given off during any stage of the distillation, change the receiver until such fumes cease to appear. Finally, determine in the distillate the amount of absolute hydrobromic acid (1 Gm. of the diluted acid should require from 1.17 to 1.30 mils of normal potassium hydroxide V.S. for neutralization), and add to the remaining weighed distillate such an amount of cold distilled water as shall cause the finished acid to contain 10 per cent. by weight of absolute hydrobromic acid.

This process is based upon that proposed by Dr. E. R. Squibb, the acid preferred by him having, however, the strength of 34 per cent. instead of 10 per cent. In fact an acid of about this strength is commercially obtainable to-day.

$$\underset{\text{Potassium Bromide}}{KBr} + \underset{\text{Sulphuric Acid}}{H_2SO_4} = \underset{\text{Acid Potassium Sulphate}}{KHSO_4} + \underset{\text{Hydrobromic Acid}}{HBr}$$

Diluted Hydrobromic Acid (*Precipitation Process*).—Dissolve 340 grains of potassium bromide in 4 fluidounces of water, add 430 grains of tartaric acid to the solution, cool the mixture to 4.4° C. (40° F.), allowing it to stand without agitation as long as possible before pouring off the clear solution from the precipitated acid potassium tartrate. If it can be kept in a cool place for several weeks before it is used, it will be improved; it will contain about 10 per cent. of absolute hydrobromic acid. This method is a modification of Wade's and Fothergill's processes, and has the advantage of separating the acid potassium tartrate more effectually. The crystals which form upon the bottom and sides of the bottle act as nuclei, and in time serve to abstract all of the acid tartrate from the liquid.

Official Description.—A colorless liquid.

Odor, Taste, and Reaction.—Odorless; strongly acid to the taste; strongly acid to litmus.

Specific Gravity.—About 1.076 at 25° C. (77° F.).

Tests for Identity.—On distilling it, weak acid passes over first; when the temperature of 126° C. (258.8° F.) is reached, an acid of 48 per cent. remains, which may be distilled unchanged.

Silver nitrate T.S. produces a yellowish-white precipitate, which is insoluble in diluted nitric acid, slowly soluble in an excess of stronger ammonia water, but readily soluble in a 10 per cent. solution of sodium thiosulphate.

Impurities and Tests for Impurities.—*Residue.*—Evaporate 25 mils of Diluted Hydrobromic Acid from a platinum or porcelain dish and afterwards dry it at 110° C. (230° F.); not more than 0.0025 Gm. of residue remains.

Sulphuric Acid.—The addition of 1 mil of barium chloride T.S. to 10 mils of the Acid produces not more than a slight cloudiness.

Barium.—The addition of 1 mil of potassium sulphate T.S. to 10 mils of the Acid causes no turbidity.

Free Bromine.—Shake 10 mils of the Acid with 2 mils of chloroform; no color is imparted to the latter.

Iodine.—Now add 5 drops of ferric chloride T.S. to the bromine test and shake the mixture; the chloroform does not acquire a violet tint.

Heavy Metals.—Ten mils of Diluted Hydrobromic Acid, without further acidulation, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Mix 5 mils of Diluted Hydrobromic Acid with 1 mil of nitric acid and evaporate the liquid to dryness on a water bath; the residue meets the requirements of the Test for arsenic (see U. S. P., Test No 1, Chapter LXII).

Chloride.—Mix 0.5 mil of Diluted Hydrobromic Acid with 10 mils of distilled water, add 8 mils of silver nitrate T.S., and 6 mils of ammonium carbonate T.S., digest the mixture for ten minutes on a water bath, cool and filter. The filtrate, on supersaturating with nitric acid, does not at once become more than slightly turbid.

Assay.—Pour about 20 mils of Diluted Hydrobromic Acid into a tared flask, weigh accurately, dilute with 30 mils of distilled water, and titrate the liquid with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows not less than 9.5 per cent. nor more than 10.5 per cent. of HBr.

Each mil of normal potassium hydroxide V.S. used corresponds to 0.08093 Gm. of HBr. Each gramme of Diluted Hydrobromic Acid corresponds to not less than 1.17 mils nor more than 1.30 mils of normal potassium hydroxide V.S.

N. F. Preparation.—Elixir Calcii Bromidi.

Uses.—Diluted hydrobromic acid is used as a nervine and hypnotic, in doses of 15 minims (1 mil).

ACIDUM HYDRIODICUM DILUTUM. U. S. Diluted Hydriodic Acid

[Acid. Hydriod. Dil.]

An aqueous solution containing not less than 9.5 per cent. nor more than 10.5 per cent. of HI (127.93). Preserve it in amber-colored, glass-stoppered bottles, protected from light, and do not dispense it if it contains free iodine.

	Metric	Old form
***Potassium Iodide**	135.0 Gm.	4 oz. av. 420 gr.
Potassium Hypophosphite	10.0 Gm.	161 grains
Tartaric Acid	136.5 Gm.	5 oz. av. 5 gr.
Distilled Water,		
Diluted Alcohol, each, a sufficient quantity,		
To make	1000 Gm.	2 pints

Dissolve the potassium salts in 250 mils [old form 8 fl. oz.] of distilled water with the aid of heat, and the tartaric acid in 400 mils [old form 12 fl. oz.] of diluted alcohol. Having poured the solution of tartaric acid into a bottle of about 1000 mils [old form 2 pints] capacity, add the solution of the potassium salts and shake the mixture briskly. Cool the mixture to about 5° C. (41° F.) for several hours and, having inserted a pledget of purified cotton tightly in the throat of a funnel, transfer the contents of the bottle to the funnel. When all the liquid has passed through, wash the bottle and crystalline precipitate with diluted alcohol in successive small portions until the filtrate weighs 1000 Gm. [or measures 2 pints]. Evaporate the liquid at a moderate temperature, on a water bath, until all of the alcohol has evaporated, and add sufficient distilled water to make the product weigh 1000 Gm. [or measure 2 pints].

Diluted Hydriodic Acid was introduced into the U. S. Pharmacopœia for the purpose of quickly preparing syrup of hydriodic acid (see page 327). The process is similar to that for preparing diluted hydrobromic acid (see page 661), potassium iodide being decomposed by tartaric acid, acid potassium tartrate crystallizing out; the use of diluted alcohol and the cooling of the liquid are depended upon to assist in separating the crystals.

$$\underset{\substack{\text{Potassium}\\\text{Iodide}}}{KI} + \underset{\text{Tartaric Acid}}{H_2C_4H_4O_6} = \underset{\substack{\text{Hydriodic}\\\text{Acid}}}{HI} + \underset{\substack{\text{Acid Potassium}\\\text{Tartrate}}}{KHC_4H_4O_6}$$

The object of adding potassium hypophosphite is to protect the diluted acid from discoloration through the possible liberation of iodine, hypophosphorous acid, a reducing agent and preservative, being introduced through the action of the tartaric acid on potassium hypophosphite. If any free iodine is liberated, this acid is oxidized to phosphoric acid and hydriodic acid is produced by the action on the iodine, both products being colorless.

$$\underset{\substack{\text{Hypophosphorous}\\\text{Acid}}}{H_3PO_2} + \underset{\text{Iodine}}{2I_2} + \underset{\text{Water}}{2H_2O} = \underset{\substack{\text{Hydriodic}\\\text{Acid}}}{4HI} + \underset{\substack{\text{Phosphoric}\\\text{Acid}}}{H_3PO_4}$$

Traces of potassium iodide, acid potassium tartrate, or hypophosphorous acid will not affect the medicinal action of the finished product.

Official Description.—A colorless or not more than pale yellow liquid.

Odor, Taste, and Reaction.—Odorless; a strongly acid taste; strongly acid to litmus.

Specific Gravity.—About 1.100 at 25° C. (77° F.).

Tests for Identity.—Add a few drops of ferric chloride T.S. or chlorine water to Diluted Hydriodic Acid, diluted with twice its volume of distilled water; iodine is liberated and imparts to the solution a reddish-brown color. On agitating this mixture with a few drops of chloroform, the latter acquires a violet color.

Impurities and Tests for Impurities.—*Free Iodine.*—No blue color is produced on adding a few drops of starch T.S. to 5 mils of the Acid.

Residue.—5 mils of Diluted Hydriodic Acid, when evaporated to dryness on a water bath and the residue ignited, leaves not more than 0.165 Gm. of residue.

Sulphuric Acid.—The addition of 1 mil of barium chloride T.S. to 10 mils of Diluted Hydriodic Acid produces not more than a slight cloudiness.

Barium.—The addition of 1 mil of potassium sulphate T.S. to 10 mils of the Acid causes no turbidity.

Chloride.—Mix 0.5 mil of Diluted Hydriodic Acid with 10 mils of distilled water, add 8 mils of silver nitrate T.S. and 6 mils of ammonium carbonate T.S., digest the mixture for ten minutes on a water bath, cool, and filter. The filtrate, upon supersaturating with nitric acid, does not become more than slightly opalescent.

Heavy Metals.—Ten mils of Diluted Hydriodic Acid, without further acidulation, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Mix 5 mils of Diluted Hydriodic Acid with 1 mil of nitric acid and evaporate the liquid to dryness on a water bath; the residue meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Pour about 5 mils of Diluted Hydriodic Acid into a tared flask, weigh accurately, dilute with 20 mils of distilled water, add 50 mils of tenth-normal silver nitrate V.S. and shake the mixture well. Now add 5 mils of nitric acid, heat the mixture on a water bath until the precipitate has a bright yellow color, cool and add 2 mils of ferric ammonium sulphate T.S. The residual titration with tenth-normal potassium sulphocyanate V.S. shows not less than 9.5 per cent. nor more than 10.5 per cent. of HI.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.012793 Gm. of HI. Each gramme of Diluted Hydriodic Acid corresponds to not less than 7.4 mils nor more than 8.2 mils of tenth-normal silver nitrate V.S.

U. S. P. Preparation.—Syrupus Acidi Hydriodici.

Uses.—Although this liquid is used mainly for dilution with syrup (see Syrupus Acidi Hydriodici, page 327), it is sometimes given internally in doses of five to ten minims (0.3 to 0.6 mil).

ACIDUM NITRICUM. U. S. Nitric Acid
[Acid. Nitric.]

An aqueous solution containing not less than 67 per cent. nor more than 69 per cent. of HNO_3 (63.02). Preserve it in dark amber-colored, glass-stoppered bottles, and protect it from light.

Preparation.—Nitric acid is prepared from N_2O_5, one of the five compounds of nitrogen and oxygen; these are nitrogen monoxide, or hyponitrous oxide (laughing gas), N_2O; nitrogen dioxide, N_2O_2 or $(NO)_2$; nitrous oxide, N_2O_3; nitrogen tetroxide or peroxide, N_2O_4; and nitric oxide, N_2O_5. From this latter, by the addition of water, nitric acid is formed, $N_2O_5 + H_2O = (HNO_3)_2$. Nitric acid is prepared commercially by reacting on sodium nitrate or *Chili saltpetre* with sulphuric acid. Sodium nitrate is preferred as the source, because it is cheaper than potassium nitrate, and, in addition, it affords a larger yield of nitric acid. If two molecules of the sodium salt and one of the sulphuric acid be taken, the reactions will be as follows:

$$\underset{\substack{\text{Sodium}\\\text{Nitrate}}}{NaNO_3} + \underset{\substack{\text{Sulphuric}\\\text{Acid}}}{H_2SO_4} = \underset{\substack{\text{Acid Sodium}\\\text{Sulphate}}}{NaHSO_4} + \underset{\substack{\text{Nitric}\\\text{Acid}}}{HNO_3}$$

It is possible, by raising the heat, to bring about a second reaction in which the acid sodium sulphate acts upon the second molecule of sodium nitrate as follows:

$$\underset{\substack{\text{Sodium}\\\text{Nitrate}}}{NaNO_3} + \underset{\substack{\text{Acid Sodium}\\\text{Sulphate}}}{NaHSO_4} = \underset{\substack{\text{Sodium}\\\text{Sulphate}}}{Na_2SO_4} + \underset{\substack{\text{Nitric}\\\text{Acid}}}{HNO_3}$$

Commercially, however, it has not been found desirable to force this second reaction and the process is discontinued with the production of the acid sodium sulphate.

During the last few years nitric acid has been made from atmospheric nitrogen in enormous quantities by means of the electric furnace, especially in Norway where the electric current is produced cheaply by water power. The nitric acid so obtained, being weak, is transformed directly into calcium nitrate and this, in turn, treated with sulphuric acid, the operation being started by the addition of a little nitric acid. Even in the cold, concentrated nitric acid is formed and the insoluble calcium sulphate is separated by filtration. Many other processes for preparing nitric acid from atmospheric nitrogen have been proposed and a number of them are in successful operation.

The specific gravity of the official acid, or, as it is technically termed, 43° acid, is 1.403 at 25° C. (77° F.). That which is usually furnished in commerce is not so strong as this, but has the specific gravity of 1.355, and is known as 38° acid. Care should always be observed to specify, in ordering from the manufacturing chemist or dealer, the specific gravity of the acid desired, for if preparations are to be made, like the official solutions of iron, success cannot be expected if acids of official strength are not used. The reddish acid, called *nitrous acid*, is nitric acid containing more or less nitrogen tetroxide (N_2O_4). The same acid may be formed by passing nitrogen dioxide (N_2O_2) into nitric acid. When exposed to sunlight the pure acid soon undergoes decomposition, developing N_2O_4 and a red color. It should therefore be kept in a dark place.

Official Description.—A fuming liquid, very caustic and corrosive.

Odor and Reaction.—Peculiar, somewhat suffocating odor; strongly acid to litmus, even when highly diluted.

Specific Gravity.—About 1.403 at 25° C. (77° F.).

Tests for Identity.—It is volatilized at 110° C. (230° F.).

Nitric Acid dissolves copper, mercury, silver, and many other metals with the evolution of brownish-red fumes, and stains woollen fabrics and animal tissues a bright yellow.

Impurities and Tests for Impurities.—*Non-volatile Impurities.*—Evaporate 20 mils of Nitric Acid from a platinum or porcelain dish and dry at 110° C. (230° F.); not more than 0.003 Gm. of residue remains.

Iodine or Bromine.—Shake 2.5 mils of Nitric Acid, diluted with 7.5 mils of distilled water, with 2 mils of chloroform; the latter remains colorless.

Iodic or Bromic Acid.—Even after the introduction of a small piece of metallic tin.

Heavy Metals.—Nitric Acid diluted with 25 volumes of distilled water and neutralized with ammonia water does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Evaporate 0.5 mil of Nitric Acid to dryness on a water bath; the residue meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Sulphuric Acid.—Separate portions of Nitric Acid, diluted with 10 volumes of distilled water, do not yield a precipitate upon the addition of barium chloride T.S. or

Hydrochloric Acid.—Of silver nitrate T.S.

Assay.—Pour about 2 mils of Nitric Acid into a tared flask containing 10 mils of distilled water, stopper, weigh accurately, dilute with 50 mils of distilled water and titrate with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows not less than 67 per cent. nor more than 69 per cent. of HNO_3.

Each mil of normal potassium hydroxide V.S. used corresponds to 0.06302 Gm. of HNO_3. Each gramme of Nitric Acid corresponds to not less than 10.63 mils nor more than 10.95 mils of normal potassium hydroxide V.S.

U. S. P. Preparations.—Acidum Nitrohydrochloricum; Acidum Nitrohydrochloricum Dilutum; Liquor Ferri Chloridi; Liquor Ferri Subsulphatis; Liquor Ferri Tersulphatis; Liquor Zinci Chloridi; Magma Bismuthi; Unguentum Hydrargyri Nitratis.

N. F. Preparations.—Glyceritum Bismuthi; Liquor Ferri Nitratis; Liquor Ferri Oxysulphatis; Liquor Hydrargyri Nitratis; Mistura Camphoræ Acida.

Uses.—Nitric acid, sometimes called *aqua fortis,* is used in pharmaceutical operations to form nitrates and as an oxidizing agent. Free nitric acid, however, will evolve oxygen when heated to a high temperature, according to the following reaction:

$$\underset{\text{Nitric Acid}}{4HNO_3} = \underset{\substack{\text{Nitrogen}\\\text{Tetroxide}}}{2N_2O_4} + \underset{\text{Oxygen}}{O_2} + \underset{\text{Water}}{2H_2O}$$

It oxidizes sulphur and phosphorus (giving rise to sulphuric and phosphoric acids) and all the metals, with a few exceptions. It combines with salifiable bases and forms nitrates. Medicinally, nitric acid, when taken internally in doses of five to ten minims (0.3 to 0.6 mil), largely diluted, is tonic, antiseptic, and astringent; when applied to the skin it is escharotic, producing a yellow stain, due to the formation of *xanthoproteic acid.*

Diluted Nitric Acid which was official in the U. S. P. VIII will now be found among the reagents (see Chapter LXII).

ACIDUM NITROHYDROCHLORICUM. U. S. Nitrohydrochloric Acid

[**Acid. Nitrohydrochl.**—NITROMURIATIC ACID]

A strong aqueous solution containing hydrochloric acid, nitric acid, nitrosyl chloride, and chlorine.

	Metric	Old form
***Nitric Acid**	**18 mils**	**1 fl. oz.**
Hydrochloric Acid	**82 mils**	**4½ fl. oz.**
To make about	**100 mils**	**5½ fl. oz.**

Mix the acids in a capacious glass vessel, and, when effervescence has ceased, pour the product into dark amber-colored, glass-stoppered bottles, which must not be more than half filled, and must be kept in a cool place.

Note.—Do not dispense Nitrohydrochloric Acid which does not immediately liberate iodine when one drop of the Acid is added to 1 mil of an aqueous solution of potassium iodide (1 in 5).

When nitric acid is mixed with hydrochloric acid, mutual decomposition takes place, according to the reaction

$$\underset{\text{Nitric Acid}}{HNO_3} + \underset{\substack{\text{Hydrochloric}\\\text{Acid}}}{3HCl} = \underset{\substack{\text{Nitrosyl}\\\text{Chloride}}}{NOCl} + \underset{\text{Chlorine}}{Cl_2} + \underset{\text{Water}}{2H_2O}$$

and a liquid is formed, capable of dissolving gold, called *aqua regia.*

The value of this acid depends upon the completion of the above reaction and the production of nitrosyl chloride and free chlorine. It should be kept in a cool dark place, on account of its liability to lose chlorine by heat, and to have its chlorine converted into hydrochloric acid by the action of light and the decomposition of water. Because of its tendency to decompose, it should not be made in large quantities, nor be kept on hand very long; and should always be tested as directed in the above "Note" before being dispensed; care should be taken not to transfer it to the bottle in which it is to be dispensed, until effervescence has ceased, lest the pressure within should drive out the stopper or cause the bottle to explode violently.

Official Description.—A golden-yellow, fuming, and very corrosive liquid.

Odor and Reaction.—It has a strong odor of chlorine; intensely acid to litmus, afterwards bleaching it.

Tests for Identity.—It readily dissolves gold leaf and 1 drop of it, added to 1 mil of potassium iodide T.S., liberates iodine.

Impurities and Tests for Impurities.—*Residue.*—Not more than 0.0035 Gm. of residue remains on evaporating 10 mils of the Acid in a glass or porcelain dish and drying at 110° C. (230° F.).

Uses.—Nitrohydrochloric acid, or, as it is still called, nitromuriatic acid, is given internally in hepatic affections, in doses of three minims (0.2 mil) and upward, well diluted with water. Great care should be taken in dispensing this acid, particularly if directed in combination with infusions, tinctures, etc.; the reaction occurring upon mixing should be permitted to cease entirely before dispensing, to avoid the possibility of an explosion taking place when the preparation is in the patient's hands.

ACIDUM NITROHYDROCHLORICUM DILUTUM. U. S. Diluted Nitrohydrochloric Acid

[**Acid. Nitrohydrochl. Dil.**—Diluted Nitromuriatic Acid]

A diluted aqueous solution containing hydrochloric acid, nitric acid, nitrosyl chloride, and chlorine.

	Metric	Old form
***Nitric Acid**	**10.0 mils**	1 fl. oz.
Hydrochloric Acid	**45.5 mils**	4½ fl. oz.
Distilled Water	**194.5 mils**	19½ fl. oz.
To make about	**250 mils**	25 fl. oz.

Mix the acids in a capacious glass vessel, and, when effervescence has ceased, add the distilled water; pour it into dark amber-colored, glass-stoppered bottles and keep it in a cool place.

It should be made strictly according to the official directions. The acids must be mixed while concentrated, otherwise the nitrosyl chloride and chlorine are not produced. Hence the "rapid method," so frequently used, of mixing the acids and immediately diluting with water, does not produce an official preparation, and is reprehensible in practice.

Note.—Do not dispense Diluted Nitrohydrochloric Acid which does not immediately liberate iodine when five drops of the Acid are added to 1 mil of an aqueous solution of potassium iodide (1 in 5).

Official Description.—A colorless or pale yellow liquid.

Odor, Taste, and Reaction.—It has a faint odor of chlorine, a very acid taste and is strongly acid to litmus, afterwards bleaching it.

Tests for Identity.—Not more than 0.0015 Gm. of residue remains on evaporating 20 mils of the Acid in a glass or porcelain dish and drying at 110° C. (230° F.). When it is added to potassium iodide T.S., iodide is liberated.

Uses.—Diluted nitrohydrochloric acid is given in doses of fifteen minims (1 mil), properly diluted, as a tonic and stimulant to the liver.

ACIDUM SULPHURICUM. U. S. Sulphuric Acid

[Acid. Sulphuric.]

A liquid containing not less than 93 per cent. nor more than 95 per cent. of H_2SO_4 (98.09). Preserve it in glass-stoppered bottles.

Preparation.—The reaction by which Sulphuric Acid is obtained in the "lead chamber process" has been the subject of careful investigation. According to one theory, which has been recognized for many years, the sulphur dioxide, SO_2, obtained by burning sulphur or iron pyrites, FeS_2, is allowed to mix with nitrous fumes obtained from the decomposition of sodium nitrate, which changes SO_2 into sulphur trioxide, SO_3, and this uniting with steam yields sulphuric acid, H_2SO_4. If the sulphur were burned by itself, the product would be sulphur dioxide, which contains only two-thirds as much oxygen as sulphur trioxide. The object of the sodium nitrate is to furnish, by its decomposition, the requisite additional quantity of oxygen. To understand the process, it is necessary to remember that several of the oxides of nitrogen have oxidizing power. The reactions are thus expressed:

$$\underset{\substack{\text{Sulphur}\\\text{Dioxide}}}{2SO_2} + \underset{\substack{\text{Nitrogen}\\\text{Tetroxide}}}{N_2O_4} = \underset{\substack{\text{Sulphur}\\\text{Trioxide}}}{2SO_3} + \underset{\substack{\text{Nitrogen}\\\text{Dioxide}}}{N_2O_2};$$

then

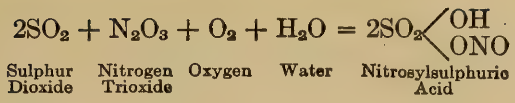
$$\underset{\substack{\text{Nitrogen}\\\text{Dioxide}}}{N_2O_2} + \underset{\text{Oxygen}}{O_2} = \underset{\substack{\text{Nitrogen}\\\text{Tetroxide}}}{N_2O_4};$$

then

$$\underset{\substack{\text{Sulphur}\\\text{Trioxide}}}{SO_3} + \underset{\text{Water}}{H_2O} = \underset{\substack{\text{Sulphuric}\\\text{Acid}}}{H_2SO_4};$$

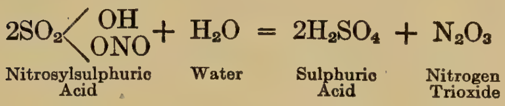
in which the sulphur dioxide, from the burning pyrites or sulphur, is oxidized to sulphur trioxide by the nitrogen tetroxide, which readily parts with two atoms of oxygen to such bodies as sulphur dioxide, and then takes two atoms of oxygen again from the atmosphere, regenerating the original tetroxide. The nitrogen tetroxide thus acts simply as a carrier of atmospheric oxygen, whereby the SO_2 is changed into SO_3. This latter compound then unites with steam to form H_2SO_4, the final product.

According to a later theory, advanced by Lunge and Naef, the sulphur dioxide combines with nitrogen trioxide, N_2O_3, oxygen from the air, and water, in the form of steam, to produce an intermediate crystalline product termed *nitrosylsulphuric acid.* This, in turn, in the presence of steam, is immediately decomposed into sulphuric acid, the nitrogen trioxide being again regenerated. The reactions are as follows:



$$\underset{\text{Sulphur Dioxide}}{2SO_2} + \underset{\text{Nitrogen Trioxide}}{N_2O_3} + \underset{\text{Oxygen}}{O_2} + \underset{\text{Water}}{H_2O} = \underset{\text{Nitrosylsulphuric Acid}}{2SO_2\left\langle\begin{matrix}OH\\ONO\end{matrix}\right.}$$

then



$$\underset{\text{Nitrosylsulphuric Acid}}{2SO_2\left\langle\begin{matrix}OH\\ONO\end{matrix}\right.} + \underset{\text{Water}}{H_2O} = \underset{\text{Sulphuric Acid}}{2H_2SO_4} + \underset{\text{Nitrogen Trioxide}}{N_2O_3}$$

This acid is made on an immense scale and the term "lead chamber process" is derived from the fact that the reactions take place in lead-lined rooms. Sulphur is used most largely in the United States as the source of production, while pyrites is used almost exclusively abroad. As the latter nearly always contains arsenical compounds, the foreign commercial product is contaminated with them.

Sulphuric Acid is now made on a large scale by what is termed the "contact method," in which the sulphur dioxide from burning sulphur or pyrites, cooled to a temperature between 380° and 450° C. (716° and 842° F.) is caused to pass over what is termed a catalytic agent, resulting in the extraction of oxygen from the air and the production of SO_3, which in turn is dissolved in water or, for complete absorption, in concentrated sulphuric acid. As much as 99 per cent. of the theoretical yield of sulphuric acid is thus obtained. Various substances have been used as the catalytic agents, which are themselves not altered during the reaction. Platinised asbestos, finely subdivided platinum distributed over a magnesium salt, vanadium pentoxide, and the sulphates of thorium, cerium and praseodymium have all been employed. This process is more easily operated than the "lead chamber process" and the pure acid can be produced at less cost so that it will probably in time entirely replace the latter process.

Official Description.—A colorless liquid, of oily consistence, very caustic and corrosive.

Odor and Reaction.—Strongly acid to litmus, even when highly diluted; odorless.

Specific Gravity.—About 1.83 at 25° C. (77° F.).

Solubility.—Miscible with water or alcohol, with the evolution of much heat; the Acid must be added with great caution to the diluent.

Tests for Identity.—When heated on platinum foil, it is vaporized with the evolution of dense fumes.

Sulphuric Acid chars cane sugar, wood, and many other organic substances.

Impurities and Tests for Impurities.—*Nitric or Nitrous Acid.*—Pour a layer of ferrous sulphate T.S. carefully upon 3 mils of Sulphuric Acid, contained in a test tube, and cool the liquid; the zone of contact does not assume a brown or reddish-brown color.

Lead.—No precipitate is formed within an hour on mixing Sulphuric Acid with 4 or 5 volumes of alcohol.

Sulphuric Acid conforms to the tests for identity and purity given under *Acidum Sulphuricum Dilutum* when diluted to that strength.

Assay.—Pour about 1 mil of Sulphuric Acid into a tared flask, stopper, weigh accurately, dilute with 50 mils of distilled water, cool the solution and titrate with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows not less than 93 per cent. nor more than 95 per cent. of H_2SO_4.

Each mil of normal potassium hydroxide V.S. used corresponds to 0.049045 Gm. of H_2SO_4. Each gramme of Sulphuric Acid corresponds to not less than 18.96 mils nor more than 19.37 mils of normal potassium hydroxide V.S.

U. S. P. Preparations.—Acidum Sulphuricum Aromaticum; Acidum Sulphuricum Dilutum; Liquor Ferri Subsulphatis; Liquor Ferri Tersulphatis; Spiritus Ætheris Nitrosi.

N. F. Preparation.—Oleum Æthereum.

Uses.—Sulphuric acid is the most powerful of the official inorganic acids. It is employed in making many preparations, mostly on account of its energetic action in decomposing salts, and the large use made of its compounds with metals, alkaloids, and other bodies. It is rarely used in the pure state as an escharotic, owing to its tendency to spread. When accidentally dropped upon the skin, a quick and profuse application of magnesia will prove effective. Unless the quantity of acid is very small, care should be used in applying water, except when a very large quantity can be applied at once, as the amount of heat produced when water is mixed with sulphuric acid increases the pain. Internally, sulphuric acid is administered either in its diluted form or as aromatic sulphuric acid.

ACIDUM SULPHURICUM AROMATICUM. U. S. Aromatic Sulphuric Acid
[Acid. Sulph. Arom.]

Aromatic Sulphuric Acid contains free sulphuric acid and ethylsulphuric acid together equivalent to not less than 19 per cent. nor more than 21 per cent. of H_2SO_4 (98.09). Preserve it in glass-stoppered bottles.

	Metric	Old form
***Sulphuric Acid**	**109 mils**	3 fl. oz. 234 min.
Tincture of Ginger	**50 mils**	1 fl. oz. 288 min.
Oil of Cinnamon	**1 mil**	15 minims
Alcohol, a sufficient quantity,		
To make	**1000 mils**	2 pints

Add the sulphuric acid gradually, and with great caution, to 700 mils [old form 22½ fl. oz.] of alcohol, and allow the mixture to cool. Then add to it the tincture of ginger and the oil of cinnamon, and afterwards enough alcohol to make the product measure 1000 mils [old form 2 pints].

Official Description.—A clear, reddish-brown liquid.

Odor and Reaction.—A pleasant, aromatic odor; strongly acid to litmus.

Test for Identity.—When added to barium chloride T.S. it produces a white precipitate, insoluble in hydrochloric acid.

Specific Gravity.—About 0.933 at 25° C. (77° F.).

Assay.—Pour about 10 mils of Aromatic Sulphuric Acid into a tared flask, stopper, weigh accurately, transfer to a small flask, using 60 mils of distilled water to rinse the weighing-flask, and, having connected the flask with a reflux condenser, boil the liquid for six hours. When cold, dilute it with distilled water to about 100 mils and titrate with normal potassium hydroxide V.S., methyl orange T.S. being used as indicator. It shows not less than 19 per cent. nor more than 21 per cent. of H_2SO_4.

Each mil of normal potassium hydroxide V.S. used corresponds to 0.049045 Gm. of H_2SO_4. Each gramme of Aromatic Sulphuric Acid corresponds to not less than 3.87 mils nor more than 4.28 mils of normal potassium hydroxide V.S.

N. F. Preparation.—Infusum Cinchonæ.

Uses.—This preparation, known as *elixir of vitriol*, is employed principally as a remedy in the night-sweats of phthisis. It is used somewhat as an excipient for quinine pills, to reduce their size and render them more soluble. The introduction of the acid sulphate of quinine has diminished this use. The dose is from ten to thirty minims (0.6 to 2 mils).

ACIDUM SULPHURICUM DILUTUM. U. S. Diluted Sulphuric Acid
[Acid. Sulph. Dil.]

An aqueous solution containing not less than 9.5 per cent. nor more than 10.5 per cent. of H_2SO_4 (98.09). Preserve it in glass-stoppered bottles.

	Metric	Old form
***Sulphuric Acid**	50 Gm.	1 fl. oz.
Distilled Water	420 Gm.	15 fl. oz.
To make	470 Gm.	16 fl. oz.

Pour the acid gradually, with constant stirring, into the distilled water and allow it to cool.

The strong acid is added gradually to the water, to guard against the too sudden production of heat, which might cause the fracture of a glass vessel. If "lead chamber" sulphuric acid is diluted with water, the liquid becomes slightly turbid, and in the course of a few days deposits a grayish-white powder, which is lead sulphate. Sulphuric acid prepared by the "contact method" will not show this percipitate.

The formation of this precipitate does not occur when official or chemically pure sulphuric acid is used, as the lead salt is persent only in sulphuric acid which has not been purified.

Official Description.—A colorless, odorless liquid.

Taste and Reaction.—A strongly acid taste; strongly acid to litmus.

Specific Gravity.—About 1.067 at 25° C. (77° F.).

Test for Identity.—With barium chloride T.S. it yields a white precipitate insoluble in hydrochloric acid.

Impurities and Tests for Impurities.—*Non-volatile Impurities.*—Evaporate 25 mils of Diluted Sulphuric Acid from a platinum or porcelain dish, and ignite the residue; not more than 0.0015 Gm. of residue remains after ignition.

Sulphurous or Nitrous Acid.—Ten mils of Diluted Sulphuric Acid does not at once discharge the color of 0.1 mil of tenth-normal potassium permanganate V.S.

Hydrochloric Acid.—Diluted Sulphuric Acid is not immediately affected by silver nitrate T.S.

Heavy Metals.—Ten mils of Diluted Sulphuric Acid does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Two mils of Diluted Sulphuric Acid meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Pour about 20 mils of Diluted Sulphuric Acid into a tared flask, weigh accurately, dilute with 10 mils of distilled water and titrate with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows not less than 9.5 per cent. nor more than 10.5 per cent. of H_2SO_4.

Each mil of normal potassium hydroxide V.S. used corresponds to 0.049045 Gm. of H_2SO_4. Each gramme of Diluted Sulphuric Acid corresponds to not less than 1.94 mils nor more than 2.14 mils of normal potassium hydroxide V.S.

U. S. P. Preparations.—Ferri Carbonatis Saccharatus; Ferri Sulphas Granulatus.
N. F. Preparations.—Infusum Rosæ Aromaticum; Syrupus Rosæ.

Uses.—Diluted sulphuric acid has the same properties as the acid from which it is made, except those which are dependent upon the strength of the latter. It is given internally, properly diluted, in doses of ten to thirty minims (0.6 to 2 mils).

ACIDUM PHOSPHORICUM. U. S. Phosphoric Acid
[Acid. Phos.]

A liquid containing not less than 85 per cent. nor more than 88 per cent. of H_3PO_4 (98.06). Preserve it in glass-stoppered bottles.

The above-mentioned strength is that used for Phosphoric Acid in the formulas of Pharmacopœial preparations. It is sometimes termed *syrupy phosphoric acid* on account of its consistence.

Preparation.—The process for making phosphoric acid was abandoned by the U. S. P. 1890, as it is dangerous and can be made much more profitably on the large scale.

A modification of this process, which obviates any likelihood of danger, is as follows: Pour 12 fluidounces of distilled water, mixed with 11 fluidounces of nitric acid, into a two pint flask. Add 40 grains of bromine, and shake it gently until it is dissolved. Now add two ounces of phosphorus, and set the flask aside, where the nitrous vapors may be carried off without injury. In winter-time, or if the acid is needed at once, it will be necessary to aid the reaction by a gentle heat; but if sufficient time can be allowed, the phosphorus will disappear gradually at the ordinary temperature, and no particular attention will be needed until the phosphorus is oxidized. The nearly colorless liquid remaining in the flask is then evaporated, tested for impurities by the official method, and diluted to the proper strength.

The reactions are as follows:

$$\underset{\substack{\text{Phosphorus}\\ \text{Pentabromide}}}{PBr_5} + \underset{\text{Water}}{5H_2O} = \underset{\substack{\text{Phosphoric}\\ \text{Acid}}}{H_3PO_4} + \underset{\substack{\text{Hydrobromic}\\ \text{Acid}}}{5HBr}$$

The hydrobromic acid is then decomposed by the nitric acid as follows:

$$\underset{\substack{\text{Hydrobromic}\\ \text{Acid}}}{6HBr} + \underset{\substack{\text{Nitric}\\ \text{Acid}}}{2HNO_3} = \underset{\text{Bromine}}{3Br_2} + \underset{\text{Water}}{4H_2O} + \underset{\substack{\text{Nitrogen}\\ \text{Dioxide}}}{N_2O_2}$$

This liberated bromine again reacts with fresh portions of phosphorus and thus explains why a small amount of bromine is able to convert large quantities of phosphorus into the orthophosphoric acid.

The most dangerous impurity likely to be found in the finished preparation is arsenic—its presence being traced to the sulphuric acid made from pyrites, which is often used in making the phosphorus.

Official Description.—A colorless, odorless liquid of a syrupy consistence.

Odor, Taste, and Reaction.—A strongly acid taste; strongly acid to litmus, even when highly diluted.

Specific Gravity.—About 1.72 at 25° C. (77° F.).

Tests for Identity.—When heated, the liquid loses water; at 200° C. (392° F.) it gradually begins to change to pyrophosphoric acid. At a still higher temperature, it is converted into metaphosphoric acid, which volatilizes in dense fumes, or which forms, on cooling, a transparent mass of glacial metaphosphoric acid.

Impurities and Tests for Impurities.—Phosphoric Acid conforms to the tests for identity and purity given under *Acidum Phosphoricum Dilutum* when diluted to that strength.

Assay.—Pour about 1 Gm. of Phosphoric Acid into a tared flask, stopper, and weigh accurately, transfer it to a 100 mil graduated flask and make it up to 100 mils with distilled water. Transfer 10 mils of this solution to a 100 mil graduated flask, add a drop of phenolphthalein T.S. and neutralize it with special potassium hydroxide T.S. (see Reagents, Chapter LXII). Add 50 mils of tenth-normal silver nitrate V.S. and agitate it, gradually adding zinc oxide (see Reagents, Chapter LXII) in small portions until the liquid is neutral to litmus paper. Now add distilled water to make the liquid measure 100 mils, agitate it thoroughly, filter through a dry filter, collect 50 mils of the filtrate, add 2 mils of nitric acid and 2 mils of ferric ammonium sulphate T.S. and determine the excess of silver nitrate by titration with tenth-normal potassium sulphocyanate V.S., to the production of a permanent red color. When calculated to the amount of Phosphoric Acid originally taken, it shows not less than 85 per cent. nor more than 88 per cent. of H_3PO_4.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.0032687 Gm. of H_3PO_4. Each gramme of Phosphoric Acid corresponds to not less than 260.0 mils nor more than 69.2 mils of tenth-normal silver nitrate V.S.

U. S. P. Preparations.—Acidum Phosphoricum Dilutum; Syrupus Calcii Lactophosphatis.

N. F. Preparations.—Elixir Calcii et Sodii Glycerophosphatum; Elixir Calcii Lactophosphatis; Elixir Gentianæ Glycerinatum; Liquor Phosphatum Acidus; Liquor Phosphatum Compositus; Syrupus Ferri Lactophosphatis; Syrupus Ferri, Quininæ et Strychninæ Phosphatum.

Uses.—Phosphoric acid is used to make diluted phosphoric acid and in he several galenical preparations indicated above.

ACIDUM PHOSPHORICUM DILUTUM. U. S. Diluted Phosphoric Acid

[Acid. Phos. Dil.]

An aqueous solution containing not less than 9.5 per cent. nor more than 10.5 per cent. of H_3PO_4 (98.06). Preserve it in well-stoppered bottles.

	Metric	Old form
***Phosphoric Acid**	**100 Gm.**	**2¼ fl. oz.**
Distilled Water	**765 Gm.**	**29¾ fl. oz.**
To make	**865 Gm.**	**2 pints**

Mix them.

The precipitation which sometimes occurs when phosphoric acid is mixed with tincture of ferric chloride is generally due to the presence of pyrophosphoric acid. Ferric pyrophosphate is precipitated in the form of an insoluble gelatinous precipitate.

Official Description.—A clear, colorless liquid.

Odor, Taste, and Reaction.—Odorless; strongly acid taste; strongly acid to litmus.

Specific Gravity.—About 1.057 at 25° C. (77° F.).

Tests for Identity.—Supersaturate 3 mils of Diluted Phosphoric Acid with ammonia water; the addition of magnesium sulphate T.S. (or of magnesia mixture T.S.) produces a white, crystalline precipitate. Collect this precipitate, wash it, and then dissolve it in diluted acetic acid; the solution yields a yellow precipitate with silver nitrate T.S. (distinction from *metaphosphoric or pyrophosphoric acid*).

Impurities and Tests for Impurities.—*Phosphorous or Hypophosphorous Acid.*—Warm 5 mils of Diluted Phosphoric Acid gently and add a few drops of silver nitrate T.S.; it does not become turbid or brown.

Heavy Metals.—Ten mils of Diluted Phosphoric Acid does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Two mils of Diluted Phosphoric Acid meets the requirements of the Tests for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Hydrochloric Acid.—Diluted Phosphoric Acid is not immediately affected by silver nitrate T.S.

Pyrophosphoric or Metaphosphoric Acid.—Nor is it affected, even after one hour, by the addition of an equal volume of tincture of ferric chloride.

Phosphates.—Evaporate 20 mils of Diluted Phosphoric Acid to a volume of about 4 mils on a water bath. Cool, transfer 2 mils to a graduated cylinder and add 6 mils of ether and 2 mils of alcohol; no turbidity appears.

Sulphuric Acid.—Mix 1 mil of Diluted Phosphoric Acid with 6 mils of distilled water, and add 1 mil of barium chloride T.S.; no immediate precipitate is produced.

Nitric Acid.—Mix equal parts of Diluted Phosphoric Acid and sulphuric acid and, after cooling, add a clear crystal of ferrous sulphate; no brownish color appears around the crystal.

Assay.—Pour about 1 mil of Diluted Phosphoric Acid into a tared flask, weigh accurately, transfer it to a 100 mil graduated flask, add a drop of phenolphthalein T.S., neutralize it with sodium hydroxide T.S. (free from chloride), then introduce 50 mils of tenth-normal silver nitrate V.S., agitate the liquid, and gradually add zinc oxide (free from chloride) in small portions until the mixture is neutral to litmus. Now add distilled water to make the product measure 100 mils, agitate it thoroughly, filter through a dry filter, collect 50 mils of the filtrate, add 2 mils of nitric acid and 2 mils of ferric ammonium sulphate T.S. and determine the excess of silver nitrate by titration with tenth-normal potassium sulphocyanate V.S. to the production of a permanent red color. When calculated to the amount of Diluted Phosphoric Acid originally taken, it shows not less than 9.5 per cent. nor more than 10.5 per cent. of H_3PO_4.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.0032687 Gm. of H_3PO_4. Each gramme of Diluted Phosphoric Acid corresponds to not less than 29.0 mils nor more than 32.1 mils of tenth-normal silver nitrate V.S.

Uses.—Diluted phosphoric acid is a tonic and refrigerant in doses of thirty minims (2 mils).

ACIDUM HYPOPHOSPHOROSUM. U. S. Hypophosphorous Acid

[Acid. Hypophos.]

An aqueous solution containing not less than 30 per cent. nor more than 32 per cent. of HPH_2O_2 (66.06). Preserve it in glass-stoppered bottles.

Preparation.—Hypophosphorous Acid may be made in several ways, but probably the most satisfactory method is that of carefully decomposing barium hypophosphite with diluted sulphuric acid or through the decomposition of 17 parts of calcium hypophosphite with 13 parts of oxalic acid.

Official Description.—A colorless or slightly yellow liquid.

Odor, Taste, and Reaction.—Odorless; an intensely acid taste; acid to litmus, even when highly diluted.

Specific Gravity.—About 1.130 at 25° C. (77° F.).

Tests for Identity.—When the Acid is heated in a suitable dish, water evaporates and it becomes more concentrated. On further heating between 130° and 140° C. (266° to 284° F.), it decomposes, forming hydrogen phosphide, which ignites, and phosphorous acid; the latter between 160° and 170° C. (320° to 338° F.) decomposes into hydrogen phosphide and phosphoric acid; the pasty residue finally reddens, ignites, and the last portions of unoxidized phosphorus burn out at a higher temperature.

Impurities and Tests for Impurities.—It conforms to the tests for identity and purity under *Acidum Hypophosphorosum Dilutum* when diluted to that strength.

Assay.—Pour about 7 mils of Hypophosphorous Acid into a tared and stoppered flask, weigh accurately, dilute with 50 mils of distilled water and titrate with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows not less than 30 per cent. nor more than 32 per cent. of HPH_2O_2.

Each mil of normal potassium hydroxide V.S. used corresponds to 0.06606 Gm. of HPH_2O_2. Each gramme of Hypophosphorous Acid corresponds to not less than 4.54 mils nor more than 4.84 mils of normal potassium hydroxide V.S.

U. S. P. Preparation.—Acidum Hypophosphorosum Dilutum.

N. F. Preparations.—Elixir Calcii Hypophosphitis; Elixir Cinchonæ Alkaloidorum et Hypophosphitum; Elixir Hypophosphitum; Elixir Hypophosphitum et Ferri; Elixir Sodii Hypophosphitis; Liquor Hypophosphitum; Liquor Hypophosphitum Compositus; Liquor Zinci et Ferri Compositus; Syrupus Calcii et Sodii Hypophosphitum; Syrupus Calcii Hypophosphitis; Syrupus Sodii Hypophosphitis.

Uses.—This acid is used for making diluted hypophosphorous acid and in a number of N. F. elixirs, solutions and syrups. In addition to the two official acids, a 50 per cent. acid is also to-day a commercial article.

ACIDUM HYPOPHOSPHOROSUM DILUTUM. U. S. Diluted Hypophosphorous Acid

[Acid. Hypophos. Dil.]

An aqueous solution containing not less than 9.5 per cent. nor more than 10.5 per cent. of HPH_2O_2 (66.06). Preserve it in well-stoppered bottles.

	Metric	Old form
***Hypophosphorous Acid**	100 Gm.	4¾ fl. oz.
Distilled Water	210 Gm.	11¼ fl. oz.
To make	310 Gm.	16 fl. oz.

Mix them.

Diluted hypophosphorous acid, although directed to be made by diluting hypophosphorous acid (see above), may be made in various ways; the process for diluted hydriodic acid (see page 663) includes the production of hypophosphorous acid, through the decomposition of potassium hypophosphite with tartaric acid. The trace of acid potassium tartrate left in the solution is insufficient to be considered objectionable when used medicinally.

Official Description.—A colorless liquid.

Odor, Taste, and Reaction.—Odorless; a strongly acid taste; strongly acid to litmus.

Specific Gravity.—About 1.042 at 25° C. (77° F.).

Tests for Identity.—When heated in a porcelain dish, water evaporates with the evolution of hydrogen phosphide, and further decomposition takes place as described under *Acidum Hypophosphorosum.*

With silver nitrate T.S. it yields a black precipitate of silver, and with mercuric chloride T.S., a white precipitate of mercurous chloride.

Impurities and Tests for Impurities.—*Barium.*—Neutralize 30 mils of Diluted Hypophosphorous Acid with ammonia water; not more than a slight precipitate results, and, after filtering, a portion of the filtrate, slightly acidulated with hydrochloric acid, does not become turbid upon the addition of potassium sulphate T.S.

Oxalic Acid.—Another portion of the filtrate shows no turbidity with calcium chloride T.S.

Heavy Metals.—One mil of Diluted Hypophosphorous Acid mixed with 9 mils of distilled water does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Mix 5 mils of Diluted Hypophosphorous Acid with 3 mils of nitric acid and 10 mils of distilled water, and evaporate the liquid to dryness on a water bath; the residue meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Pour about 25 mils of Diluted Hypophosphorous Acid into a tared flask, weigh accurately, add 25 mils of distilled water and titrate with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows not less than 9.5 per cent. nor more than 10.5 per cent. of HPH_2O_2.

Each mil of normal potassium hydroxide V.S. used corresponds to 0.06606 Gm. of HPH_2O_2. Each gramme of Diluted Hypophosphorous Acid corresponds to not less than 1.44 mils nor more than 1.6 mils of normal potassium hydroxide V.S.

U. S. P. Preparations.—Syrupus Ferri Iodidi; Syrupus Hypophosphitum.

N. F. Preparations.—Liquor Ferri Protochloridi; Syrupus Ammonii Hypophosphitis; Syrupus Hypophosphitum Compositus.

Uses.—This acid was introduced into the U. S. P. for the purpose of acting as a reducing agent when added to solutions of various iodides which are liable to be decomposed by the action of light and air, as in syrup of ferrous iodide, or to aid in dissolving hypophosphites in the official syrups; calcium hypophosphite frequently requiring such an addition.

Average dose.—8 minims (0.5 mil).

QUESTIONS ON HYDROGEN, OXYGEN, WATER AND THE INORGANIC ACIDS

What is the atomic weight of hydrogen? Of oxygen? Of water? Of nitrogen? (See page 650.)

Give a description of hydrogen. Of oxygen. Of nitrogen.

What percentage of oxygen by weight does water contain?

When a glowing splinter of wood is plunged into oxygen, what happens? How is oxygen marketed? What are its uses?

What is the formula in symbols of water? What amount of residue is permitted on evaporating 100 mils of water? How may metallic impurities be detected?

If the transparency or color of distilled water is affected by any of the following tests, what impurity is indicated? Test solution of barium chloride; test solution of silver nitrate; test solution of ammonium oxalate; test solution of hydrogen sulphide; test solution of calcium hydroxide; Nessler's reagent.

What amount of residue is permitted in 100 mils of distilled water?

Describe the test for the absence of organic or oxidizable substances.

What are the uses of distilled water in pharmacy?

What is the Latin official name of solution of hydrogen dioxide?

When freshly prepared, how much pure hydrogen dioxide does it contain?

To what amount of available oxygen does this correspond?

How is it prepared?

What are the uses of solution of hydrogen dioxide? What precautions should be taken to prevent decomposition? What impurities should be absent and how may their presence be detected?

What is the common name for nitrogen monoxide? How is it marketed? For what is it used?

How are acids distinguished from other bodies? (See page 656.)

What do the suffixes "ous" and "ic" designate when applied to acids?

What precautions are necessary in handling strong acids? Why?

How may glass stoppers be removed without injury from bottles in which they have become tightly fastened?

Why should corks not be used as stoppers for strong acids?

How may carboys containing strong acids be handled conveniently and safely?

What grades of acid are found in commerce?

What injurious results may follow the use of weak and impure acids?

Are the official inorganic acids uniform in strength?

What is the strength of hydrochloric acid? Of nitric acid? Of sulphuric acid?

Which of the diluted acids are uniform in strength?

What per cent. of absolute acid do they contain?

What are the medical properties of the inorganic acids?

How may their injurious action on the teeth be avoided?

What are the proper antidotes for strong acids which may have been taken in poisonous doses?

Give the formula in symbols and molecular weight of hydrochloric acid.

What is official hydrochloric acid? How is it made?

Explain the reaction which takes place in its manufacture.

For what purposes in pharmacy is hydrochloric acid used?

To what is the yellow color of the common acid usually due?

What is the cause of the white fumes which are produced when the acid is exposed to the air?

What is the specific gravity of hydrochloric acid?

What official preparations are made from hydrochloric acid?

Give the formula for diluted hydrochloric acid.

How much absolute hydrochloric acid does it contain?

What is the official test of its strength? What are its uses?

What are tests for the following impurities? Residue; bromide; iodide; free chlorine; free bromine; sulphuric acid; sulphurous acid or arsenic; heavy metals.

What is the composition of diluted hydrobromic acid?

Name the official preparations in which it is used.

Give the formula in symbols and molecular weight of hydrobromic acid.

How is diluted hydrobromic acid usually made? Describe the distillation process.

Explain the chemical reaction. Describe the precipitation process.

What chemical reaction takes place in the latter process?

What is the specific gravity of diluted hydrobromic acid?

What impurities may be present and how may they be detected?

For what is diluted hydrobromic acid used, and what is the dose?

What is the strength of diluted hydriodic acid? How is this acid made? For what is diluted hydriodic acid used? Why is potassium hypophosphite added to the formula? What impurities may be present and how may they be detected?

What are the tests for its identity?
Give the symbol and molecular weight of absolute nitric acid.
How much is contained in official nitric acid?
What five compounds are there of nitrogen and oxygen?
From which of these is nitric acid formed, and how?
How is nitric acid prepared commercially?
When made from sodium nitrate, what will be the reaction if two molecules of the sodium salt and one of sulphuric acid are used? Upon raising the heat, what further reaction takes place?
What is the specific gravity of the official acid?
What is the composition of the reddish acid called nitrous acid?
What are the tests for identity?
What impurities may be present and how may they be detected?
By what name is nitric acid sometimes called?
For what is nitric acid used in pharmaceutical operations? Name the official preparations.
Explain the decomposition which takes place when nitric acid is exposed to a red heat. What acids are produced by its action on phosphorus and sulphur?
What does it form in combination with salifiable bases?
What are its medicinal properties?
Name the official preparations of nitric acid. To what is the yellow stain due when nitric acid is applied to the skin?
What is nitrohydrochloric acid? How prepared?
What reaction takes place when nitric acid is mixed with hydrochloric acid?
What is the liquid thus formed popularly called?
Upon what does the value of this acid depend and what simple test will prove its value? What does this test show?
Why should it be kept in a cool and dark place? Describe its physical properties.
What is its medicinal use? What is the dose?
Why is especial care necessary in dispensing this acid?
Give the formula for diluted nitrohydrochloric acid.
Should all the ingredients be mixed together at once? Why?
Describe its physical properties. What are its medicinal uses and dose?
Give the symbol and molecular weight of absolute sulphuric acid.
How much does the official sulphuric acid contain?
Describe the "lead chamber process" for making sulphuric acid.
What is the principal source of production of sulphuric acid in America? What in Europe? What is the foreign commercial article apt to be contaminated with?
What is the "contact method" for preparing sulphuric acid?
What is the specific gravity of the official acid?
What are the tests for identity?
What impurities may be present and how may they be detected?
Name the official preparations.
What are its uses?
How is it administered internally?
Give the formula for aromatic sulphuric acid.
How much official sulphuric acid does it contain?
What is its specific gravity? What is its popular name?
What are its uses? What is the dose?
Give the formula for diluted sulphuric acid.
How much official sulphuric acid does it contain?
What is its specific gravity?
When commercial sulphuric acid is diluted, what precipitate is thrown down, and why?
What are the uses of diluted sulphuric acid? What is the dose?
What is official phosphoric acid?
Give the formula in symbols and molecular weight of orthophosphoric acid.
How may the official acid be prepared?
Explain the rationale of the reaction which takes place.
What dangerous impurity is likely to be present? Where does it come from?
What is the specific gravity of the official acid? What identity tests may be applied?
Name the official preparations.

What is its principal use?
How is diluted phosphoric acid made?
How much orthophosphoric acid does it contain?
What is its specific gravity?
If a precipitate occurs when this acid is mixed with tincture of ferric chloride, what is indicated?
What impurities are likely to be present and how may they be detected?
What are its uses and dose?
What is the strength of hypophosphorous acid? How may it be prepared?
For what is this acid used?
What is the Latin official name of diluted hypophosphorous acid?
How much absolute hypophosphorous acid does it contain?
What impurities are likely to be present and how may they be detected?
Give the formula in symbols and the molecular weight of hypophosphorous acid.

CHAPTER XXXIV

PREPARATIONS OF THE HALOGENS

Chlorine, Bromine, and Iodine

Cl; 35.46. Br; 79.92. I; 126.92

Four elements, *chlorine*, *bromine*, *iodine*, and *fluorine*, are termed halogens (salt-producers). Fluorine is of so little interest in pharmacy that it will not be considered; the other three are of great interest both to medicine and to pharmacy.

Chlorine Cl; 35.46

Chlorine is a greenish-yellow, gaseous body, having a very suffocating odor; its specific gravity is 2.45 (when liquefied 1.38). Its most useful and characteristic property is that of bleaching organic coloring principles; the presence of water is necessary to effect this object. Chlorine is one of the most reliable disinfectants; it is principally used in combination with lime as bleaching powder, the official name being Calx Chlorinata. Chlorine in its free state is recognized in Chlorine Water which is now among the reagents of the U. S. P. IX, and also in Compound Solution of Chlorine which has been transferred to the N. F. IV.

Chlorine combines with hydrogen and the metals, but has very little attraction for oxygen; its principal hydrogen compound is hydrochloric acid, HCl (see Acidum Hydrochloricum). The compounds of chlorine with metals and bases are termed chlorides; they will be considered under the heads of their respective bases.

Chlorine combines indirectly with oxygen, and the compounds produced by the union of the oxyacid, chloric acid, $HClO_3$, with metals or bases are termed chlorates. Perchlorates are also known.

Tests for Chlorides and Chlorates

Chlorides in solution, or hydrochloric acid, may be recognized by the addition of a solution of silver nitrate; a curdy white precipitate is produced, which is soluble in ammonia water, but insoluble in nitric acid.

Chlorates are recognized by the evolution of oxygen when heated, and by the reaction of the residue corresponding with that of chlorides.

Unofficial Preparations of Chlorine, Bromine, and Iodine

Acidum Hypochlorosum, $HClO$ Hypochlorous Acid	Agitate chlorine water with precipitated mercuric oxide. Distil the liquid to remove mercuric chloride, and collect the distillate
Acidum Chloricum, $HClO_3$ Chloric Acid	Decompose barium chlorate with an equivalent amount of pure diluted sulphuric acid; pour off the clear solution of chloric acid, and evaporate carefully *in vacuo* over strong sulphuric acid
Acidum Perchloricum, $HClO_4$ Perchloric Acid	Distil pure dry potassium perchlorate with four times its weight of concentrated (previously boiled) sulphuric acid. Collect the yellow distillate
Bromi Chloridum Bromine Chloride	Pass chlorine gas over bromine
Acidum Bromicum Bromic Acid	Decompose barium bromate with an equivalent amount of diluted sulphuric acid, filter, and evaporate
Acidum Iodicum, HIO_3 Iodic Acid	Heat 1 part iodine with 10 parts nitric acid in a retort until the iodine is dissolved and fumes cease to be evolved. Evaporate the solution, and heat the residue to 93° C. (199.4° F.) until all trace of acid is removed

Acidum Periodicum, HIO_4 Periodic Acid	Add 1 part iodine to a solution of 7 parts sodium carbonate in 100 parts water, and pass chlorine into the heated liquid until a precipitate ceases to form. Dissolve this precipitate in pure nitric acid, then add silver nitrate, and dissolve the resulting precipitate in hot diluted nitric acid. Then concentrate to crystallize. Treat the crystals with water, filter, and evaporate
Amylum Iodatum Iodized Starch	The formula $(C_6H_{10}O_5)_5I$ was at one time suggested for iodized starch, but it is doubtful if it is a definite chemical compound (see Formulary, Part VI) Iodized starch is a convenient preparation for administering iodine internally, the principal advantage being that starch forms an admirable diluent and the iodine is freed from irritant properties. The dose is two to four drachms (8 to 16 Gm.)

CALX CHLORINATA. U. S. Chlorinated Lime

[**Calx Chlorin.**—"CHLORIDE OF LIME"]

A product resulting from the action of chlorine upon calcium hydroxide, and containing not less than 30 per cent. of available chlorine [Cl = 35.46]. Preserve it in air-tight containers, in a cool and dry place.

Preparation.—Chlorinated lime is made by exposing finely powdered, dry calcium hydroxide, which has been placed on trays in a suitable chamber, to the action of chlorine. The gas is absorbed by the lime, as indicated in the following reaction:

$$\underset{\substack{\text{Calcium}\\\text{Hydroxide}}}{2Ca(OH)_2} + \underset{\text{Chlorine}}{2Cl_2} = \underset{\substack{\text{Calcium}\\\text{Hypochlorite}}}{Ca(OCl)_2} + \underset{\substack{\text{Calcium}\\\text{Chloride}}}{CaCl_2} + \underset{\text{Water}}{2H_2O}$$

This mixture of calcium hypochlorite, with a large proportion of undecomposed calcium hydroxide, constitutes the so-called "chloride of lime" of commerce. A condensation of the formula into $CaOCl_2$ (obtained by adding together $Ca(OCl)_2$ and $CaCl_2$ and dividing by two) is frequently used to designate chlorinated lime in chemical reactions. The calcium chloride is of no value in the product, but is a detriment, owing to its hygroscopic character and the fact that the absorbed water decomposes the hypochlorite according to the following reaction:

$$\underset{\substack{\text{Calcium}\\\text{Hypochlorite}}}{Ca(OCl)_2} + H_2O = Ca(OH)_2 + \underset{\substack{\text{Hydrochlorous}\\\text{Acid}}}{HClO}$$

Free acids, such as hydrochloric, decompose chlorinated lime as follows:

$$\underset{\substack{\text{Calcium}\\\text{Hypochlorite}}}{Ca(OCl)_2} + \underset{\substack{\text{Calcium}\\\text{Chloride}}}{CaCl_2} + \underset{\substack{\text{Hydrochloric}\\\text{Acid}}}{2HCl} = \underset{\text{Chlorine}}{4Cl} + \underset{\substack{\text{Calcium}\\\text{Chloride}}}{2CaCl_2} + \underset{\text{Water}}{2H_2O}$$

Even the carbon dioxide of the air can bring about a similar reaction when chlorinated lime is exposed and this accounts for its deodorant and disinfectant properties for which it is so widely employed.

A very excellent method of preservation is now in vogue in which the dry chlorinated lime is hermetically sealed in metallic zinc boxes.

Official Description.—A white, or grayish-white, granular powder. It becomes moist and gradually decomposes on exposure to the air and when in such condition must not be used or dispensed.

Odor.—It has the odor of chlorine.

Solubility.—Partially soluble in water or alcohol. The insoluble portion settles readily when it is mixed with water. If lumps are present they readily break down and leave no core.

Tests for Identity.—Shake 1 Gm. of Chlorinated Lime with 50 mils of distilled water and filter; the filtrate at first colors red litmus blue, and then bleaches it.

Dissolve Chlorinated Lime in diluted acetic acid; an abundance of chlorine gas is evolved, and only a trifling residue remains undissolved.

Ammonium oxalate T.S. added to this solution yields a white precipitate, insoluble in acetic acid, but soluble in hydrochloric acid.

Assay.—Introduce into a tared, stoppered weighing-bottle, containing 10 mils of distilled water, between 3 and 4 Gm. of Chlorinated Lime and weigh accurately. Triturate this thoroughly with 50 mils of distilled water, transfer the mixture to a graduated liter flask, rinse the mortar with distilled water, add the rinsings to the mixture and then sufficient distilled water to make 1000 mils, stopper the flask and allow it to stand for ten minutes. Shake it thoroughly, add to 100 mils of the mixture 1 Gm. of potassium iodide and 5 mils of acetic acid, and titrate with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator. When calculated to the weight of Chlorinated Lime taken, it shows not less than 30 per cent. of available chlorine.

Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.003546 Gm. of available chlorine (Cl). Each gramme of Chlorinated Lime corresponds to not less than 84.6 mils of tenth-normal sodium thiosulphate V.S.

U. S. P. Preparation.—Liquor Sodæ Chlorinatæ.
N. F. Preparation.—Liquor Potassæ Chlorinatæ.

Uses.—Chlorinated lime is used in the preparation of solution of chlorinated soda, but most largely as a disinfectant, through its power of arresting animal and vegetable putrefaction. It is rarely given internally, but is sometimes used as a stimulant and alterative, in doses of three to six grains (0.2 to 0.38 Gm.). Externally, it is used in solution as an application to ulcers, burns, etc.

LIQUOR SODÆ CHLORINATÆ. U. S. Solution of Chlorinated Soda

[Liq. Sod. Chlorinat.—Labarraque's Solution]

An aqueous solution of chlorine compounds of sodium, containing not less than 2.5 per cent. of available Cl. Preserve the Solution in well-stoppered bottles, in a cool place, protected from light.

	Metric	Old form
***Monohydrated Sodium Carbonate**	**70 Gm.**	**9 oz. av. 148 gr.**
Chlorinated Lime	**100 Gm.**	**13 oz. av. 149 gr.**
Water, a sufficient quantity,		
To make	**1000 Gm.**	**8 pints**

Triturate the chlorinated lime with 500 mils [old form 4 pints] of water gradually added until a uniform mixture results. Dissolve the monohydrated sodium carbonate in 500 mils [old form 4 pints] of hot water, and add this solution to the chlorinated lime mixture contained in a suitable vessel. Stir or shake the mixture thoroughly and if it becomes gelatinous warm the vessel very gently until its contents again liquefy. Then transfer the mixture to a wetted muslin strainer, returning the first portion until the liquid passes through clear, and when no more liquid drains from it, wash the precipitate with enough water to make the product weigh 1000 Gm. [or measure 8 pints].

Double decomposition results in the formation of insoluble calcium carbonate or precipitated chalk, while sodium hypochlorite and sodium chloride remain in solution.

$$\underset{\text{Chlorinated Lime}}{Ca(OCl)_2} + CaCl_2 + \underset{\text{Sodium Carbonate}}{2Na_2CO_3} = \underset{\text{Chlorinated Soda}}{2NaOCl} + 2NaCl + \underset{\text{Calcium Carbonate}}{2CaCO_3}$$

Official Description.—A clear, pale greenish liquid.

Odor, Taste, and Reaction.—It has a faint odor of chlorine and a disagreeable, alkaline taste; it at first colors red litmus paper blue, and then bleaches it.

Test for Identity.—The addition of hydrochloric acid to the Solution causes an evolution of chlorine and carbon dioxide.

Assay.—Mix in a flask about 7 mils of Solution of Chlorinated Soda, accurately weighed, with 50 mils of distilled water, add 1 Gm. of potassium iodide and 5 mils of acetic acid and titrate with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator. It shows not less than 2.5 per cent. of available Cl.

Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.003546 Gm. of available Cl. Each gramme of Solution of Chlorinated Soda corresponds to not less than 7 mils of tenth-normal sodium thiosulphate V.S.

Uses.—Solution of chlorinated soda, or "Labarraque's Solution," is principally employed as a disinfectant or bleaching solution A similar preparation is official in the N. F. under the title Liquor Potassæ Chlorinatæ and is commonly called *Eau de Javelle or Javelle water.* It is made with potassium carbonate instead of sodium carbonate and contains less available chlorine. The process is given on page 683.

A solution of chlorinated soda, in which the alkali is neutralized, containing from 0.45 to 0.5 per cent. of chlorinated soda, has been extensively used as a disinfectant in the treatment of wounds under the title *Carrel-Dakin Solution* (see Formulary, Part VI).

LIQUOR CHLORI COMPOSITUS. N. F. Compound Solution of Chlorine

(Replacing U. S. P. VIII)

[Liq. Chlor. Co.—Chlorine Water]

An aqueous solution containing, when freshly made, a mixture of chlorine and chlorine oxides equivalent to about 0.35 Gm. of available chlorine in each 100 mils of the solution, with some potassium chloride.

	Metric	Old form
Potassium Chlorate, granulated..................	3.5 Gm.	51 grains
Hydrochloric Acid	10.0 mils	154 minims
Distilled Water, a sufficient quantity,		
To make..............................	500 mils	1 pint

Graduate a bottle of not less than 1000 mils [old form 2 pints] capacity to 500 mils [old form 1 pint] and fit it with a tightly fitting stopper having two perforations. Through one of these perforations pass a funnel tube fitted with a stop-cock and through the other a straight glass tube about 8 mm. (5⁄16 inch) in diameter and 7 cm. (about 3 inches) in length. Place the potassium chlorate in the bottle and add the hydrochloric acid, previously mixed with 10 mils [old form 154 mimins] of distilled water, through the funnel tube. Close the stop-cock and place the bottle on a water bath for a few moments or until the potassium chlorate is dissolved and the bottle completely filled with a gas having a greenish-yellow color. Then remove the bottle from the water bath and add cold distilled water in several portions through the funnel, agitating thoroughly after each addition until the liquid measures 500 mils [old form 1 pint].

This Solution should not be dispensed unless it has been recently prepared and then only in well-filled, amber-colored bottles.

Official Description.—A yellow liquid.

Odor, Taste, and Reaction.—It has a strong odor and taste of chlorine.

Tests for Identity.—One drop when added to 5 mils of potassium iodide T.S. liberates iodine.

When evaporated to dryness on a water bath it leaves a white residue consisting mainly of potassium chloride.

Chlorine water was official in the U. S. P. 1890 and the process is now included among the reagents of the U. S. P. IX (see chapter LXII). In its preparation hydrochloric acid is heated with 10 Gm. of manganese dioxide and the generated chlorine conducted into 400 mils of distilled water until a saturated solution is produced. The reaction is shown below:

$$\underset{\substack{\text{Manganese}\\\text{Dioxide}}}{MnO_2} + \underset{\substack{\text{Hydrochloric}\\\text{Acid}}}{4HCl} = \underset{\substack{\text{Manganese}\\\text{Chloride}}}{MnCl_2} + \underset{\text{Chlorine}}{Cl_2} + \underset{\text{Water}}{2H_2O}$$

The chlorine water must be kept secluded from the light, to prevent its partial conversion into hydrochloric acid through the decomposition of the water by the union of the chlorine with its hydrogen.

The little apparatus shown in Fig. 265 or 266 is well adapted for making small quantities of chlorine water rapidly. The process for compound solution of chlorine, adopted by the U. S. P. VIII and now transferred to the N. F. IV, produces a "chlorine water" which is equally efficient for medical purposes and far more readily prepared. The slight traces of potassium chloride and the oxides of chlorine which are present when made in this way may be ignored when used medicinally; but it is not so well suited for reagent purposes and hence the introduction of "chlorine water" among the reagents.

Uses.—Compound solution of chlorine, or chlorine water, is antiseptic and stimulant; it is given in doses of from thirty to sixty minims (2 to 4 mils) diluted with water; it is used as a gargle in scarlet fever, diphtheria, and similar diseases. Chlorine in the gaseous state is largely used as a disinfectant. A convenient means of generating it is by the well-known *chlorine saucer disinfectant;* this is made by pouring half a fluidounce of equal measures of sulphuric acid and water upon two hundred grains of a finely ground mixture of equal parts of black manganese oxide and common salt, contained in a saucer. Chlorine is gradually evolved from this mixture for several days.

LIQUOR POTASSÆ CHLORINATÆ. N. F. Solution of Chlorinated Potassa

[**Liq. Pot. Chlorinat.**—LIQUOR POTASSÆ CHLORATÆ JAVELLE WATER]

	Metric	Old form
Potassium Carbonate	**58 Gm.**	1 oz. av. 410 gr.
Chlorinated Lime	**80 Gm.**	2 oz. av. 293 gr.
Water, a sufficient quantity,		
To make about	**1000 mils**	2 pints

Mix the chlorinated lime intimately with 400 mils [old form about 12½ fl. oz.] of water. Dissolve the potassium carbonate in 300 mils [old form about 9½ fl. oz.] of boiling water, and pour the hot solution into the mixture first prepared. Shake the flask or bottle well, stopper it, set it aside to cool, and then add sufficient water to make the product measure 1000 mils [old form 2 pints] and filter. Keep the Solution in well-stoppered bottles, in a cool place and protected from the light.

BROMUM. N. F. Bromine

(U. S. P. VIII)

It contains not less than 98 per cent. of Br (79.92) and not more than 2 per cent. of Cl. Preserve Bromine in glass-stoppered bottles in a cool place, the bottle being enclosed in a larger vessel with the space between filled with some substance capable of absorbing and combining with any vapors which might escape.

Preparation.—This non-metallic element, which is in the form of a dark red, volatile liquid, is produced largely in the United States, in Michigan, Ohio, West Virginia, and Pennsylvania. It is prepared from the brine obtained from salt-wells by the following process. The brine is concentrated to separate chlorides, sulphates, etc., by crystallization. The mother liquor, containing the bromine principally in the form of magnesium bromide, is decomposed by treating it with chlorine gas.

The manner of conducting this process is peculiar. The original salt liquor, or brine, is pumped out of the ground and evaporated to about 15° B. in large iron pans, then allowed to settle, and is further evaporated to the point of crystallization in wooden tanks heated by steam pipes. These tanks, five in number, are placed at different elevations, one above the other. Each day the liquor is run off from No. 1, the highest, to No. 2, next day to No. 3, and so on until it reaches No. 5, the crystallized salt being removed from each tank after draining off the liquor. The brine which reaches No. 5 is termed *bittern*, and consists chiefly of calcium, magnesium, sodium, and aluminum chlorides, with varying percentages of sodium and calcium bromides.

The bittern marking 30° to 38° B. is evaporated to about 45° B. The liquor is then run into stone stills, materials for generation of chlorine added, and heat applied by means of steam until the bromine has all been vaporized. It is condensed and collected in cooled receivers.

$$\underset{\text{Magnesium Bromide}}{MgBr_2} + \underset{\text{Chlorine}}{2Cl} = \underset{\text{Magnesium Chloride}}{MgCl_2} + \underset{\text{Bromine}}{2Br}$$

A process has also been perfected for the separation of the bromine from the "bittern" by electrolytic methods and this is being successfully conducted on a commercial scale.

On account of its very caustic and irritating properties, *great care* must be used in handling bromine. Its vapor is very corrosive and suffocating.

Chemically, there is a close analogy between bromine and chlorine. Its combination with hydrogen is hydrobromic acid, which is official as a 10 per cent. acid (see page 661).

The salts, termed bromides, are used very largely in medicine. They will be considered under the heads of their respective bases. *Bromates*, formed, like chlorates, by combination with the corresponding oxyacid, bromic acid, $HBrO_3$, are rarely used.

Tests for Bromine and Bromides

1. If a solution of a bromide be treated with a solution of silver nitrate, a yellowish-white precipitate of silver bromide is produced, which is insoluble in nitric acid and but slightly soluble in ammonia water.

2. If chlorine water be added to a strong solution of a bromide, bromine is liberated. This may be dissolved by agitation with carbon disulphide, chloroform, or ether.

3. If concentrated sulphuric acid be added to a bromide (not in solution), reddish vapors of bromine are evolved.

Official Description.—A heavy, dark brownish-red, mobile liquid, evolving, even at ordinary temperatures, reddish fumes, highly irritating to the eyes and lungs.

Odor, Taste, and Reaction.—It has a peculiar, suffocating odor, resembling that of chlorine.

Specific Gravity.—About 3.016 at 25° C. (77° F.).

Tests for Identity.—On exposure to air it volatilizes.

It destroys the color of solutions of litmus or indigo, and imparts a yellow color to starch T.S.

Boiling Point.—About 63° C. (145.4° F.).

Solubility.—One mil dissolves in about 90 mils of water; it is freely soluble in alcohol, ether, chloroform, or carbon disulphide.

Impurities and Tests for Impurities.—*Organic Bromine Compounds.*—Add 5 mils of Bromine to an excess of sodium hydroxide T.S.; it combines to form a permanently clear liquid, without the separation of oily drops.

Iodine.—Shake 10 mils of a saturated aqueous solution of Bromine with a slight excess of reduced iron until it becomes nearly colorless, filter the liquid and add 5 drops of ferric chloride T.S. and 5 drops of starch T.S.; it does not assume a blue color.

Assay.—Dissolve 10 Gm. of potassium iodide in 25 mils of distilled water, introduce the solution into a 100 mil measuring flask, stopper and determine accurately the weight of the flask and its contents. Add about 1 Gm. of Bromine to the contents of the flask, determine its exact weight and then fill the flask to the mark with distilled water and titrate 25 mils of this solution with tenth-normal sodium thiosulphate V.S., using starch T.S. as indicator. It shows not less than 98 per cent. of Br with not more than 2 per cent. of Cl.

Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.007992 Gm. of Br or 0.003546 Gm. of Cl. Each gramme of Bromine (containing not more than 2 per cent. of chlorine) corresponds to not more than 128.3 mils of tenth-normal sodium thiosulphate V.S.

N. F. Preparations.—Liquor Arsenicalis, Clemens; Liquor Auri et Arseni Bromidi; Liquor Bromi.

Uses.—Bromine is rarely used in its undiluted condition. When diluted with water in the proportion of forty minims in a pint, it forms a powerful wash. It is the important ingredient in *Bibron's antidote* to rattlesnake poison, which is made by dissolving three hundred grains of bromine in half a pint of diluted alcohol, placing four grains of potassium iodide and two grains of corrosive mercuric chloride in a mortar; adding sufficient of the solution to dissolve the salts, and mixing it with the rest of the solution. The *utmost care* should be exercised in handling bromine: the vapor not only attacks the eyes and nostrils, but renders the air irrespirable. It acts on metallic surfaces, and may ruin balances if permitted to remain in contact with them.

LIQUOR BROMI. N. F. Solution of Bromine

[**Liq. Brom.**—Smith's Solution of Bromine]

	Metric	Old form
Bromine	**8.3 mils**	160 minims
Potassium Bromide	**12.5 Gm.**	228 grains
Water, a sufficient quantity,		
To make	**100 mils**	4 fl. oz.

Dissolve the potassium bromide in 80 mils [old form 3¼ fl. oz.] of water, contained in a bottle, add the bromine, and shake the mixture until solution is effected. Finally add sufficient water to make the product measure 100 mils [old form 4 fl. oz.].

Keep the Solution in glass-stoppered bottles in a dark place.

IODUM. U. S. Iodine

It contains not less than 99.5 per cent. of I (126.92). Preserve it in glass-stoppered bottles, in a cool place.

Preparation.—Iodine is a non-metallic element widely distributed in nature. It was formerly exclusively obtained from *kelp* or *varec*, the ashes of certain sea-weeds. In addition to this source, it is now made from the mother liquors obtained from the crystallization of sodium nitrate in South America. These contain the iodine in the form of sodium iodide and sodium iodate. The iodides are decomposed by chlorine, iodine being set free, while the iodine from the iodates is precipitated by treatment with acid sodium sulphite. The liquid obtained by lixiviating kelp contains the iodine as sodium iodide and potassium iodide. A concentrated solution of the impure iodide is treated with sulphuric acid, then distilled with manganese dioxide; the separated iodine condenses in a series of glass or earthenware receivers.

$$\underset{\substack{\text{Sodium}\\\text{Iodide}}}{2NaI} + \underset{\substack{\text{Sulphuric}\\\text{Acid}}}{2H_2SO_4} + \underset{\substack{\text{Manganese}\\\text{Dioxide}}}{MnO_2} = \underset{\text{Iodine}}{I_2} + \underset{\substack{\text{Manganese}\\\text{Sulphate}}}{MnSO_4} + \underset{\substack{\text{Sodium}\\\text{Sulphate}}}{Na_2SO_4} + \underset{\text{Water}}{2H_2O}$$

Iodine of excellent quality is now readily obtained; the presence of a small quantity of water, however, is often noticed.

Tests for Iodine and Iodid

1. A dark blue color (fading upon the application of heat) is produced when iodine is brought in contact with starch mucilage.
2. An iodide is detected by first liberating the iodine by adding a little chlorine water and then using starch mucilage; or if carbon disulphide is added, the iodine dissolves in it.
3. Silver nitrate produces with a solution of an iodide a yellowish-white precipitate of silver iodide, which is insoluble in nitric acid and but slightly soluble in ammonia water.
4. A yellow precipitate of lead iodide is produced by adding a solution of lead salt to a neutral solution of an iodide.
5. A red precipitate of mercuric iodide is produced by adding a solution of mercuric chloride to a neutral solution of an iodide.

Official Description.—It occurs as heavy, bluish-black, brittle, rhombic plates, having a metallic luster.

Odor and Taste.—It has a distinctive odor, and a sharp and acrid taste.

Specific Gravity.—About 4.66 at 17° C. (62.6° F.).

Tests for Identity.—Iodine imparts a deep brown, evanescent stain to the skin, and slowly destroys vegetable colors. Iodine volatilizes slowly at ordinary temperatures. When heated to about 114° C. (237.2° F.), it fuses and is gradually dissipated in the form of a purple vapor, leaving not more than 0.05 per cent. of residue.

Solubility.—One Gm. of Iodine dissolves in 2950 mils of water, 12.5 mils of alcohol, 80 mils of glycerin, and in 4 mils of carbon disulphide at 25° C. (77° F.); freely soluble in chloroform, ether, or aqueous solutions of iodides; its solution in alcohol or in an aqueous solution of potassium iodide has a reddish-brown color; its diluted solution in chloroform or carbon disulphide has a violet color.

Add starch T.S. to a saturated aqueous solution of Iodine; a blue color is produced. On boiling the mixture the color is discharged but reappears as it cools, unless it has been subjected to long continued boiling.

Impurities and Tests for Impurities.—*Moisture.*—A solution of Iodine in chloroform is transparent.

To determine the presence of cyanogen, chlorine or bromine, proceed as follows:

Cyanogen Iodide.—Triturate 0.5 Gm. of finely powdered Iodine with 20 mils of distilled water and filter the solution. To one-half of the filtrate carefully add tenth-normal sodium thiosulphate V.S. until the solution is just decolorized. Then add a few drops of ferrous sulphate T.S., and subsequently a little sodium hydroxide T.S., and heat the mixture gently. On now adding a slight excess of hydrochloric acid, the liquid does not become blue.

Chlorine or Bromine.—To the other half of the aqueous filtrate, in a test tube, add a slight excess of silver nitrate T.S., shake the liquid actively, allow the precipitate to subside, and, having poured off the clear, supernatant liquid completely, shake the precipitate with a mixture of 1 mil of ammonia water and 9 mils of distilled water, and filter. On adding a slight excess of nitric acid to the filtrate, not more than a slight opalescence makes its appearance.

Assay.—Introduce about 0.5 Gm. of powdered Iodine into a tared weighing-bottle, stopper, weigh accurately, and add 1 Gm. of potassium iodide dissolved in 5 mils of distilled water. Dilute this solution with distilled water to about 50 mils and titrate with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator. It shows not less than 99.5 per cent. of I.

Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.012692 Gm. of I. Each gramme of Iodine corresponds to not less than 78.4 mils of tenth-normal sodium thiosulphate V.S.

U. S. P. Preparations.—Liquor Iodi Compositus; Pilulæ Ferri Iodidi; Syrupus Ferri Iodidi; Tinctura Iodi; Unguentum Iodi.

N. F. Preparations.—Collodium Iodi; Linimentum Ammonii Iodidi; Liquor Iodi Phenolatus (from Compound Solution); Petroxolinum Iodi; Petroxolinum Iodi Dilutum; Phenolum Iodatum; Sulphuris Iodidum; Syrupus Calcii Iodidi; Syrupus Ferri etMangani Iodidi; Syrupus Iodotannicus; Tinctura Iodi Decolorata; Tinctura Iodi Fortior.

Iodine is closely related chemically to bromine and chlorine. Its combination with hydrogen (hydriodic acid) is official in the form of a diluted acid of from 9.5 to 10.5 per cent. strength and also as Syrupus Acidi Hydriodici, the syrup and free hypophosphorous acid preserving it from decomposition. The iodides are largely used in medicine. The iodates, like the chlorates and bromates, are produced by combination with the oxyacids of iodine, iodic and periodic acids. They are of little interest pharmaceutically.

Uses.—Iodine is very largely used in medicine. It excites the action of the absorbent and glandular systems, and is employed both internally and externally. The average dose is one-twelfth grain (0.005 Gm.).

LIQUOR IODI COMPOSITUS. U. S. Compound Solution of Iodine

[**Liq. Iodi Co.**—Lugol's Solution]

An aqueous solution containing not less than 4.8 per cent. nor more than 5.2 per cent. of I and not less than 9.8 per cent. nor more than 10.2 per cent. of KI. Preserve the solution in glass-stoppered bottles, protected from light.

	Metric	Old form
***Iodine**	5 Gm.	175 grains
Potassium Iodide	10 Gm.	350 grains
Distilled Water, a sufficient quantity,		
To make	100 Gm.	8 oz. av.

Dissolve the iodine and potassium iodide in a sufficient quantity of distilled water to make the product weigh 100 Gm. [old form 8 oz. av.].

As iodine dissolves sparingly in water, the potassium iodide is added to render it more soluble. The solution contains about 3 grains of iodine in the fluidrachm.

Official Description.—A transparent liquid of a deep brown color.

Odor.—It has an odor of iodine.

Tests for Identity.—A drop of the Solution when added to 1 mil of starch T.S., diluted with 10 mils of water, produces a deep blue color.

Assay for Potassium Iodide.—Evaporate in a tared, porcelain dish on a water bath about 5 mils of Compound Solution of Iodine, accurately weighed in a stoppered weighing-bottle, repeatedly moisten the residue with distilled water and re-evaporate until it becomes white. It leaves a residue of not less than 9.8 per cent. nor more than 10.2 per cent. of a salt which responds to the tests for identity and purity under *Potassii Iodidum.*

Assay for Iodine.—Dilute about 10 mils of Compound Solution of Iodine, accurately weighed in a stoppered weighing-bottle, with 25 mils of distilled water and titrate with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator. It shows not less than 4.8 per cent. nor more than 5.2 per cent. of I.

Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.012692 Gm. of I. Each gramme of Compound Solution of Iodine corresponds to not less than 3.8 mils nor more than 4.1 mils of tenth-normal sodium thiosulphate V.S.

Uses.—This Solution affords an efficient means of administering iodine internally. It is given in three minim (0.2 mil) doses, and, to prevent gastric irritation, it must be largely diluted.

SYRUPUS ACIDI HYDRIODICI. U. S. *Syrup of Hydriodic Acid*

This is a syrupy liquid containing from 1.3 to 1.45 Gm. of hydriodic acid [HI; 127.93] and having the specific gravity 1.215 (see page 327). It is prepared officially by mixing 125 mils of diluted hydriodic acid with 300 mils of distilled water and 575 mils of syrup.

The object of this preparation is to furnish an agreeable mode of administering hydriodic acid, and also a liquid which will be reasonably stable. *Hydriodic acid,* HI, is easily decomposed in simple aqueous solution (unless protected by hypophosphorous acid as in the official process), free iodine being liberated, and if taken internally, when in this condition, serious results might follow. This Syrup is best made extemporaneously, for, upon standing, the sugar becomes caramelized through contact with the free acid. Syrup of hydriodic acid was formerly made by passing hydrogen sulphide through an alcoholic solution of iodine (see U. S. P. 1880). The chemical reaction which takes place may be expressed as follows:

$$\underset{\text{Iodine}}{4I} + \underset{\text{Hydrogen Sulphide}}{2H_2S} = \underset{\text{Hydriodic Acid}}{4HI} + \underset{\text{Sulphur}}{2S}$$

Official Description.—A transparent, colorless, or not more than pale straw-colored, syrupy liquid.

Odor and Taste.—Odorless, and having a sweet and acidulous taste.

Specific Gravity.—About 1.215 at 25° C. (77° F.).

Tests for Identity.—Mix 5 mils of Syrup of Hydriodic Acid with a few drops of starch T.S. and add three drops of chlorine water; the liquid acquires a deep blue color.

Impurities and Tests for Impurities.—*Free Iodine.*—No blue color is produced in the Syrup by starch T.S. alone.

Assay.—Introduce exactly 25 mils of Syrup of Hydriodic Acid into a flask, dilute it with 100 mils of distilled water, add 40 mils of tenth-normal silver nitrate V.S., agitate the mixture, add 5 mils of diluted nitric acid and 2 mils of ferric ammonium sulphate T.S. and titrate with tenth-normal potassium sulphocyanate V.S. It shows, in each 100 mils, not less than 1.3 Gm. nor more than 1.45 Gm. of HI.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.012793 Gm. of HI.

Uses.—Syrup of hydriodic acid is used as an alterative. The dose is twenty to sixty minims (1.3 to 4 mils).

LIQUOR IODI PHENOLATUS. N. F. Phenolated Solution of Iodine

[**Liq. Iod. Phenol.**—LIQUOR IODI CARBOLATUS, N. F. III. CARBOLIZED SOLUTION OF IODINE BOULTON'S SOLUTION FRENCH MIXTURE]

	Metric	Old form
Compound Solution of Iodine	**15 mils**	230 minims
Liquefied Phenol	**6 mils**	92 minims
Glycerin	**165 mils**	5 fl. oz. 135 min.
Water, a sufficient quantity,		
To make	**1000 mils**	**2 pints**

Mix the liquefied phenol with the compound solution of iodine, add the glycerin and sufficient water to make the product measure 1000 mils [old form 2 pints]. Then expose the liquid to sunlight until it has become colorless.

QUESTIONS ON PREPARATIONS OF THE HALOGENS

What is meant by the term "halogen"? (See page 679.)
What four elements are called "halogens"?
Describe chlorine. Give its symbol and molecular weight.
What is its specific gravity?
What is its most characteristic property?
What is its principal use, and how is it generally employed?
What is its principal hydrogen compound?
What are its compounds with metals and bases termed?
When combined with oxygen, what are its compounds with metals and bases termed?
How may chlorides in solution or hydrochloric acid be recognized?
How may chlorates be recognized?
What is chlorinated lime? Give its Latin name.
How much available chlorine should it contain?
How is it prepared? How preserved?
What is a popular name for it?
What are the tests for identity?
What are the official Latin and English titles for Labarraque's solution?
How much chlorine should it contain?
How is it prepared?
For what is it used?
What is Carrel-Dakin solution? What per cent. of sodium hypochlorite should it contain?
What is compound solution of chlorine? What is the synonym?
What amount of the gas should it contain?
What substances does it contain besides chlorine gas?
Explain the reaction which takes place in its production.
How is chlorine water prepared for the U. S. P. reagents? What advantage has chlorine water made by this method?
What are the uses of chlorine water?
How may chlorine be conveniently used as a disinfectant?
What is Javelle water?
In what manner does it differ from Labarraque's solution?
Give the symbol and atomic weight of bromine.
Where is it obtained, and how is it prepared?
Describe the process.
What is bittern, and what does it contain?
What is the character of the vapor of bromine?
What is its combination with hydrogen called?

What are its salts called?
What are the tests for bromine?
What is its specific gravity?
How may the presence of iodine be detected?
What is its medicinal use?
What is "Bibron's antidote" to rattlesnake poison?
Why should the utmost care be taken in handling bromine?
Name the N. F. preparations in which it is used.
What is Smith's solution of bromine?
Give the symbol and atomic weight of iodine.
How was it formerly obtained, and how is it now obtained?
Explain the reaction which takes place in its production.
What tests may be used to detect iodine or iodides?
How soluble is iodine in alcohol?
How may the following impurities be detected? Moisture; cyanogen iodide; more than traces of chlorine or bromine.
In what form is its combination with hydrogen official?
Name the U. S. P. and N. F. preparations.
What is its use in medicine?
Give the formula for compound solution of iodine.
What is its official name and synonym?
How much iodine does a fluidounce of the solution contain?
What is the object of using potassium iodide in this preparation?
How is it used medicinally, and what is the dose?
What is Boulton's solution?

CHAPTER XXXV

SULPHUR AND PHOSPHORUS

S; 32.07. P; 31.04.

These two elements furnish many important compounds to medicine. They present several analogies, both physically and chemically.

Sulphur S; 32.07

Sulphur is found uncombined in Sicily and in other parts of the world. Vast deposits of sulphur have recently been successfully worked in the vicinity of Charles Lake, Louisiana, U. S. A. An ingenious method, devised by H. Frasch, has here been introduced whereby the sulphur, from a depth of about 400 feet, is brought to the surface in a molten condition by forcing superheated water, under pressure, at a temperature of about 155° C. (311° F.), down the bored well, through an iron pipe. The heat melts the sulphur deposit and the molten sulphur rises through smaller, enclosed tubes. In order to bring the melted sulphur to the surface, heated air is forced into it, thus raising the specific gravity and causing it to rise to the surface without pumps. Here the melted sulphur is collected in large wooden boxes and allowed to solidify. The sulphur from this source is of exceptional quality, showing from 99 to 99.6 per cent. pure sulphur. In the form of sulphates and sulphides sulphur is widely distributed. The sulphur found in Sicily is prepared for use by fusing it, allowing it to stand to permit the earthy impurities to settle, and then pouring it into cylindrical moulds. The sulphur in cylinders is termed *roll sulphur*.

Large quantities of sulphur are also obtained as by-products from the Leblanc soda process and from gas works.

Three forms of sulphur are official in the U. S. P.,—sublimed, washed, and precipitated sulphur.

Sulphur forms with hydrogen an offensive gas, which is known officially as *hydrogen sulphide*, H_2S. It is also termed *sulphuretted hydrogen* and *hydrosulphuric acid*. The formula for its preparation will be found under "Tests," (see chapter LXII). It is used for proving the presence or absence of certain metallic salts, lead, bismuth, antimony, copper, mercury, zinc, etc., with which it produces characteristic precipitates. *Sulphides* are compounds of elements with sulphur and may be viewed as salts of hydrosulphuric acid. Some of the sulphides are analogous to acids, others to bases; and these different sulphides, by combining with one another, form compounds, which, from their analogy to salts, were called by Berzelius *sulpho-salts*. It forms with oxygen four oxides, *disulphur trioxide*, S_2O_3, *sulphur dioxide* (*sulphurous anhydride*), SO_2, *sulphur trioxide* (*sulphuric anhydride*), SO_3, and *sulphur heptoxide* (*persulphuric anhydride*), S_2O_7. The second and third of these oxides, by their union with water, form *sulphurous acid*, H_2SO_3, and *sulphuric acid*, H_2SO_4 respectively. These are considered in the chapter on inorganic acids. The fourth oxide also forms an acid on combination with water called *persulphuric acid*, $H_2S_2O_8$, but it is of little importance. There is also known *hyposulphurous acid*, H_2SO_2, the corresponding oxide of which is not known, and *thiosulphuric acid* (frequently known as hyposulphurous acid), $H_2S_2O_3$, and a series of acids, $H_2S_2O_6$, $H_2S_3O_6$, $H_2S_4O_6$, and $H_2S_5O_6$, known as the *thionic series*. Sulphurous acid forms with bases salts which are termed *sulphites*. The salts similarly produced from sulphuric acid are termed *sulphates*. The sulphates are much more important salts. Pharmaceutically and medicinally, the sulphites and sulphates have totally different properties. Those official will be considered under their respective bases.

Tests for Sulphites and Sulphurous Acid

1. Solution of barium chloride produces with sulphurous acid or a solution of a sulphite, a white precipitate of barium sulphite, which is soluble in hydrochloric acid.
2. A solution of a sulphite or sulphurous acid, added to diluted sulphuric acid and zinc, liberates hydrogen sulphide gas.
3. An acid solution of potassium permanganate is decolorized and deoxidized by sulphurous acid.

Tests for Sulphates and Sulphuric Acid

1. A solution of barium chloride produces a white insoluble precipitate of barium sulphate with sulphuric acid or a soluble sulphate.
2. A soluble salt of lead produces a white insoluble precipitate of lead sulphate with sulphuric acid or a soluble sulphate.

Unofficial Compounds and Preparations of Sulphur and Phosphorus

Acidum Hyposulphurosum, H_2SO_2 Hyposulphurous Acid	Add metallic zinc to sulphurous acid contained in a closed vessel and separate the zinc sulphite
Acidum Metaphosphoricum, HPO_3 Metaphosphoric Acid	Evaporate a solution of phosphoric acid until the residue ceases to give off water
Acidum Phosphorosum, H_3PO_3 Phosphorous Acid	Expose phosphorus to moist air under a bell-jar, and collect the heavy white vapor which falls, in a vessel containing water
Acidum Pyrophosphorosum, $H_4P_2O_7$ Pyrophosphorous Acid	Precipitate sodium pyrophosphate with a solution of lead acetate, and decompose the well-washed lead pyrophosphate with hydrogen sulphide
Spiritus Phosphori Spirit of Phosphorus U. S. P. 1890	Weigh 1.2 Gm. of phosphorus in a tared dish containing water, dry it quickly with the aid of blotting paper, and transfer it at once to a flask containing 1000 mils of absolute alcohol. Having connected the flask with an upright condenser, boil the liquid gently on a water-bath until the phosphorus is dissolved, cool, and add enough absolute alcohol to make 1000 mils. Store in small dark-colored vials
Carbonei Disulphidum Carbon Disulphide. U. S. P. VIII	Prepared by passing sulphur vapor over red-hot charcoal (see tests)
Hydrogen Sulphide	Made by acting on ferrous sulphide with dilute sulphuric acid (see tests)
Resina Phosphorata Phosphorated Rosin Phosphoretted Resin	Melt together, by the aid of a sand-bath, in a dry bottle having the nearly exact capacity of the ingredients, rosin free from moisture 96 parts and phosphorus 4 parts. Keep the whole at a temperature of 200° C. (392° F.) until the phosphorus is dissolved, cool, and keep in bottles protected from light

SULPHUR SUBLIMATUM. U. S. Sublimed Sulphur

[**Sulphur Sublim.**—FLOWERS OF SULPHUR]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99.5 per cent. of S (32.07).

Preparation.—When vapors of sulphur are conducted into a chamber properly cooled, they are condensed in the form of a crystalline powder, which collects on the sides and bottom of the chamber. The yellowish powder is known as sublimed sulphur, or *flowers of sulphur. Ground roll sulphur* is sometimes sold as "*flour of sulphur*"; it is not equal in quality to the official sublimed sulphur.

Official Description.—A fine, yellow powder.

Odor and Taste.—It has a slight, characteristic odor, and a faintly acid taste.

Solubility.—Practically insoluble in water and nearly insoluble in alcohol; it is slightly soluble in ether; soluble or partially soluble in carbon disulphide, chloroform, or olive oil.

Tests for Identity.—At about 115° C. (239° F.) it fuses to a yellow, mobile fluid, which upon further heating becomes dark and viscid. In the air it burns to sulphur dioxide, characterized by its odor.

Impurities and Tests for Impurities.—The amount of residue left after volatilizing or igniting a weighed portion of well-dried Sublimed Sulphur does not exceed 0.5 per cent.

Assay.—Transfer about 1 Gm. of Sublimed Sulphur, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed, to a flask containing 50 mils of a 10 per cent. solution of potassium hydroxide. Boil the mixture until the liquid is of a transparent, golden-yellow color and then dilute it with distilled water to make a volume of exactly 250 mils. Oxidize 25 mils of this diluted solution by the addition of solution of hydrogen dioxide in excess (using about 50 mils), and heat on a water bath for thirty minutes. Then acidulate the liquid with hydrochloric acid, and dilute it with 100 mils of distilled water. Now heat it to boiling and add hot barium chloride T.S., in small portions, to the resulting liquid until no further precipitation takes place. Heat this mixture on a water bath for thirty minutes, collect the resulting precipitate on a filter, wash, dry, ignite, and weigh the barium sulphate. Carry out a blank determination, using the same amount of all of the reagents but omitting the Sulphur, and before making the final calculation deduct the amount of barium sulphate thus obtained from that obtained in the assay. It shows, in the dried product, not less than 99.5 per cent. of S.

Each gramme of Sublimed Sulphur, previously dried, corresponds to not less than 7.243 Gm. of barium sulphate.

U. S. P. Preparations.—Sulphur Lotum; Sulphur Præcipitatum; Unguentum Sulphuris.

N. F. Preparations.—Liquor Calcis Sulphuratæ; Petroxolinum Sulphuratum; Petroxolinum Sulphuratum Compositum; Unguentum Sulphuris Alkalinum; Unguentum Sulphuris Compositum.

Uses.—Sublimed sulphur is given internally as a laxative and diaphoretic, in doses of from one to three drachms (4 to 12 Gm.). It is often combined with potassium bitartrate and administered to children mixed with honey or molasses. The National Formulary contains a formula for a troche in which sulphur and potassium bitartrate are combined. In diphtheritic croup it is sometimes used to remove the exudation by insufflation; externally, it is used as an ointment in scabies and other skin diseases.

SULPHUR LOTUM. U. S. Washed Sulphur

[**Sulphur Lot.**]

Washed Sulphur, when dried to constant weight in a desiccator over sulphuric acid, contains not less than 99.5 per cent. of S (32.07).

	Metric	Old form
*Sublimed Sulphur	100 Gm.	16 oz. av.
Ammonia Water	10 mils	1½ fl. oz.
Water, a sufficient quantity.		

Pass the sublimed sulphur through a No. 30 sieve, mix it thoroughly with 100 mils [old form 1 pint] of water, add the ammonia water and set the mixture aside for three days in a closed vessel, agitating occasionally. Then add 100 mils [old form 1 pint] of water, transfer the mixture to a strainer, and wash the sulphur with water until the washings cease to impart a blue color to red litmus paper. Then allow it to drain, press the residue strongly, dry it rapidly at a moderate heat in a drying closet, pass it through a No. 30 sieve, and keep it in well-closed containers.

Sublimed Sulphur is frequently contaminated with small quantities of sulphurous acid and other impurities, and the object of the ammonia in the above process is to neutralize any acid that may be present, the ammonium sulphate being subsequently washed out, and also to wash out any impurity of arsenic sulphide.

Official Description.—A fine, yellow powder.

Odor, Taste, and Reaction.—Without odor or taste.

Solubility and Tests for Identity.—It responds to the solubility and identity tests under *Sulphur Sublimatum.*

Impurities and Tests for Impurities.—*Acid or Alkali.*—Agitate 2 Gm. of Washed Sulphur with 10 mils of distilled water and filter; the filtrate is neutral to litmus.

Residue.—The amount of residue left after volatilizing or igniting a weighed portion of dried Washed Sulphur does not exceed 0.5 per cent.

Arsenic.—Digest 0.5 Gm. of Washed Sulphur for three hours with 10 mils of ammonia water, filter the liquid, and evaporate the clear filtrate to dryness on a water bath. Then add 1 mil of nitric acid, and again evaporate to dryness. This residue meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—When dried to constant weight in a desiccator over sulphuric acid and assayed by the method under *Sulphur Sublimatum,* it shows, in the dried product,—not less than 99.5 per cent. of S.

Each gramme of Washed Sulphur, previously dried, corresponds to not less than 7.243 Gm. of barium sulphate.

U. S. P. Preparation.—Pulvis Glycyrrhizæ Compositus.

N. F. Preparations.—Sulphuris Iodidum; Trochisci Sulphuris et Potassii Bitartratis.

Uses.—Washed sulphur is preferred to sublimed sulphur for internal administration; the small quantity of sulphurous acid present in the latter sometimes produces griping. The dose is from one to three drachms (4 to 12 Gm.).

SULPHUR PRÆCIPITATUM. U. S. Precipitated Sulphur

[Sulphur Præc.—LAC SULPHURIS MILK OF SULPHUR]

Precipitated Sulphur, when dried to constant weight in a desiccator over sulphuric acid, contains not less than 99.5 per cent. of S (32.07).

	Metric	Old form
***Sublimed Sulphur**	100 Gm.	16 oz. av.
Calcium Oxide	50 Gm.	8 oz. av.
Hydrochloric Acid,		
Water, each, a sufficient quantity.		

Shake the calcium oxide, and mix it thoroughly with 500 mils [old form 5 pints] of water. Add the sublimed sulphur, previously sifted, and, after thorough mixing, add 1000 mils [old form 10 pints] of water and boil the mixture in a porcelain or glass vessel during one hour, stirring or agitating the mixture very frequently, and replacing the water lost by evaporation. Then cover the vessel, and permit the contents to cool and become clear by subsidence. Carefully draw off the clear solution, and filter the remainder. To the united liquids add gradually and with constant stirring hydrochloric acid previously diluted with an equal volume of water, until the liquid is nearly neutralized but still retains an alkaline reaction and a yellow color. Collect the precipitate on a strainer, and wash it until the washings are neutral to litmus and cease to give a precipitate upon the addition of ammonium oxalate T.S. Then dry the product rapidly, and keep it in well-closed containers.

In the above process the lime and sulphur react so as to form soluble polysulphides of calcium. The reaction is usually given as follows:

$$\underset{\text{Sulphur}}{6S_2} + \underset{\substack{\text{Calcium}\\\text{Hydroxide}}}{3Ca(OH)_2} = \underset{\substack{\text{Calcium}\\\text{Pentasulphide}}}{2CaS_5} + \underset{\substack{\text{Calcium}\\\text{Thiosulphate}}}{CaS_2O_3} + \underset{\text{Water}}{3H_2O}$$

On the addition of hydrochloric acid, the sulphur is precipitated:

$$\underset{\substack{\text{Calcium}\\\text{Pentasulphide}}}{2CaS_5} + \underset{\substack{\text{Calcium}\\\text{Thiosulphate}}}{CaS_2O_3} + \underset{\substack{\text{Hydrochloric}\\\text{Acid}}}{6HCl} = \underset{\substack{\text{Calcium}\\\text{Chloride}}}{3CaCl_2} + \underset{\text{Sulphur}}{6S_2} + \underset{\text{Water}}{3H_2O}$$

In some processes sulphuric acid is used instead of hydrochloric acid, and calcium sulphate is precipitated with the sulphur. This furnishes an inferior product, and should not be confused with the official product. In carrying out this process it is important to follow the official instructions exactly. If the mixture is boiled longer than one hour, soluble polysulphides are formed and the final yield is lessened. If the hydrochloric acid is added in excess, the precipitated sulphur becomes coarse and much reduced in quantity, while at the same time arsenic, if present, would be precipitated.

Official Description.—A fine, amorphous powder, of a pale yellow color.

Odor and Taste.—Without odor or taste.

Solubility and Tests for Identity.—It responds to the solubility and identity tests under *Sulphur Sublimatum.* It is more readily and completely soluble in carbon disulphide than other forms of sulphur.

Impurities and Tests for Impurities.—*Acid or Alkali.*—Agitate 2 Gm. of Precipitated Sulphur with 10 mils of distilled water and filter; the filtrate is neutral to litmus.

Residue.—The amount of residue left after volatilizing or igniting a weighed portion of dried Precipitated Sulphur does not exceed 0.3 per cent.

Arsenic.—Digest 1 Gm. of Precipitated Sulphur for three hours with 10 mils of ammonia water and filter the liquid. Evaporate the clear filtrate to dryness on a water bath, add 1 mil of nitric acid, and again evaporate to dryness. This residue meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—When dried to constant weight in a desiccator over sulphuric acid and assayed by the method under *Sulphur Sublimatum*, it shows, in the dried product, not less than 99.5 per cent. of S.

Each gramme of Precipitated Sulphur, previously dried, corresponds to not less than 7.243 Gm. of barium sulphate.

N. F. Preparations.—Pasta Betanaphtholis; Pasta Zinci Sulphurata.

Uses.—Precipitated sulphur is much to be preferred to the other forms in liquid mixtures, as the particles are lighter and more easily suspended; the ointments made with it are smoother than those made with sublimed sulphur. The dose is from one to three drachms (4 to 12 Gm.).

SULPHURIS IODIDUM. N. F. Sulphur Iodide

(U. S. P. VIII)

[Sulphur. Iod.]

	Metric	Old form
Washed Sulphur	20 Gm.	60 grains
Iodine	80 Gm.	240 grains

Mix the sulphur and iodine thoroughly by trituration; introduce the mixture into a flask, close the orifice loosely, and, by means of a water bath, gradually apply a heat not exceeding 60° C. (140° F.) and occasionally agitate until the ingredients combine and become of a uniformly dark color throughout. Then increase the heat to the boiling point of water, so as to fuse the mass. Should any iodine sublime and condense on the glass, incline the flask so as to combine the iodine with the fused mass, and then pour the latter upon a porcelain plate or other suitable cold surface. When it is cold, break the product into pieces of suitable size, and keep them in a glass-stoppered bottle, in a cool place.

This compound represents one of the instances of the direct chemical union of two elements, heat being the only agent used to effect the combination; it is sometimes called *subiodide of sulphur*, or *iodine disulphide*, S_2I_2. There are some doubts, however, as to its being a definite chemical compound.

As it is readily decomposed when exposed to air, it should be kept in tightly closed bottles.

Official Description.—It occurs in brittle masses having a crystalline fracture and a grayish-black, metallic luster.

Odor and Taste.—It has the odor of iodine and a somewhat acrid taste.

Solubility.—Almost insoluble in water; soluble in about 60 parts of glycerin; very soluble in carbon disulphide. Alcohol, ether, or an aqueous solution of potassium iodide dissolves the iodine, leaving the sulphur. Continued boiling with water vaporizes all of the iodine, leaving about 20 per cent. of sulphur as a residue.

Tests for Identity.—On exposing sulphur iodide to the air, it gradually loses iodine. On heating it, some iodine sublimes at first; at a somewhat higher temperature a sublimate is formed, containing both iodine and sulphur. At a still higher temperature, it is almost completely volatilized, leaving only a trace of residue.

Assay.—Mix 0.5 Gm. of finely powdered Sulphur Iodide with 1 Gm. of potassium iodide, and dissolve the mixture in 20 mils of distilled water (the sulphur separating); not less than 28 mils of tenth-normal sodium thiosulphate V.S. is required for complete decolorization of the mixture, starch T.S. being used as an indicator.

Uses.—Sulphur Iodide is principally used externally in skin diseases in the form of an ointment.

PHOSPHORUS. U. S. Phosphorus

[Phosphor.]

Phorphorus [P=31.04] must be carefully preserved under water, in strong, well-closed containers, in a secure and moderately cool place, protected from light.

Preparation.—Phosphorus is a non-metallic element. It is prepared chiefly by one of two methods. By the first of these, *bone black*, after use as a decolorizer in industrial processes, chiefly sugar refining, is burned in the air to *bone ash*, which consists chiefly of tertiary calcium phosphate. This bone ash is then treated with sulphuric acid to obtain acid calcium phosphate:

$$\underset{\substack{\text{Calcium}\\\text{Phosphate}}}{Ca_3(PO_4)_2} + \underset{\substack{\text{Sulphuric}\\\text{Acid}}}{2H_2SO_4} = \underset{\substack{\text{Calcium}\\\text{Sulphate}}}{2CaSO_4} + \underset{\substack{\text{Acid Calcium}\\\text{Phosphate}}}{CaH_4(PO_4)_2}$$

This acid calcium phosphate is now mixed with wood charcoal and the mixture heated in retorts to a red heat when calcium metaphosphate is formed which, in turn, as the heat is increased to white heat, is changed to tricalcium phosphate, carbon monoxide and free phosphorus, which distils and is condensed under water. The reactions are as follows:

$$\underset{\substack{\text{Acid Calcium}\\\text{Phosphate}}}{CaH_4(PO_4)_2} = \underset{\text{Water}}{2H_2O} + \underset{\substack{\text{Calcium}\\\text{Metaphosphate}}}{Ca(PO_3)_2}$$

$$\underset{\substack{\text{Calcium}\\\text{Metaphosphate}}}{3Ca(PO_3)_2} + \underset{\text{Carbon}}{10C} = \underset{\substack{\text{Carbon}\\\text{Monoxide}}}{10CO} + \underset{\substack{\text{Tricalcium}\\\text{Phosphate}}}{Ca_3(PO_4)_2} + \underset{\text{Phosphorus}}{P_4}$$

By the second method, a mixture consisting of phosphatic minerals, coke and quartz sand is heated to a high temperature in a pear-shaped electric furnace. The phosphorus vapors are condensed and the slag drawn off at the bottom, the process being continuous, fresh mixture being constantly added at the top of the furnace. The following reaction takes place:

$$\underset{\substack{\text{Tricalcium}\\\text{Phosphate}}}{Ca_3(PO_4)_2} + \underset{\text{Carbon}}{5C} + \underset{\substack{\text{Silicon}\\\text{Dioxide}}}{3SiO_2} = \underset{\substack{\text{Carbon}\\\text{Monoxide}}}{5CO} + \underset{\substack{\text{Calcium}\\\text{Silicate}}}{CaSiO_3} + \underset{\text{Phosphorus}}{2P}$$

Of the allotropic forms of phosphorus, *red phosphorus* is the most important. It was at one time considered to be amorphous but has been crystallized in the hexagonal system and shown to be a polymer of yellow phosphorus. It is obtained by allowing phosphorus to remain for several days in an atmosphere of carbon dioxide at a temperature varying from 215° C. (419° F.) to 250° C. (482° F.).

Red phosphorus is not luminous and not poisonous until it is heated to 280° C. (536° F.), when it is converted into ordinary phosphorus.

Phosphorus forms with oxygen two oxides,—*phosphorous*, P_2O_3, or *phosphorous trioxide*, and *phosphoric*, P_2O_5, or *phosphorous pentoxide*. Corresponding to the last of these are three acids, known as *orthophosphoric* (tribasic phosphoric), H_3PO_4, *pyrophosphoric*, $H_4P_2O_7$, and *metaphosphoric*, HPO_3. Orthophosphoric acid is formed by dissolving P_2O_5 in boiling water, or by the action of nitric acid upon phosphorus itself; pyrophosphoric acid, by the heating of the tribasic phosphoric acid to 213° C. (415.4° F.); and metaphosphoric acid, by the ignition of the tribasic variety, or by dissolving P_2O_5 in cold water. *Phos-*

phorous acid, H_3PO_3, cannot be formed directly from phosphorous trioxide. This is a dibasic acid, containing one hydrogen atom not replaceable by metal. *Hypophosphorous acid,* H_3PO_2, is not capable of being derived directly from hypophosphorous oxide, but is prepared by heating yellow phosphorus with a concentrated solution of barium or calcium hydroxide to produce barium hypophosphite by the following reaction:

$$\underset{\substack{\text{Barium}\\\text{Hydroxide}}}{3Ba(OH)_2} + \underset{\text{Phosphorus}}{2P_4} + \underset{\text{Water}}{6H_2O} = \underset{\substack{\text{Barium}\\\text{Hypophosphite}}}{3Ba(H_2PO_2)_2} + \underset{\substack{\text{Hydrogen}\\\text{Phosphide}}}{2PH_3}$$

The barium is then precipitated with sulphuric acid and the hypophosphorous acid concentrated in vacuo. It is monobasic, containing two hydrogen atoms not replaceable by metal.

Tests for Phosphates and Phosphoric Acids

1. Solution of silver nitrate produces a yellow precipitate with a neutral solution of an orthophosphate, soluble both in nitric acid and in ammonia water. It produces a white precipitate with pyrophosphoric acid or metaphosphoric acid.
2. If albumin is added to metaphosphoric acid, or to a solution of a metaphosphate containing acetic acid, a white precipitate is produced. No precipitate occurs if it is added to pyrophosphoric acid or orthophosphoric acid.
3. Official test solution of magnesium (magnesia mixture, see Chapter LXII) produces with phosphoric acid or a solution of a phosphate a precipitate of ammonio-magnesium phosphate.
4. If solution of ammonium molybdate in diluted nitric acid is added in excess to phosphoric acid or to a solution of a phosphate in nitric acid, and heat applied, a yellow precipitate of ammonium phosphomolybdate will be produced.
5. If a solution of barium chloride is added to a neutral solution of a phosphate, a white precipitate of barium phosphate is produced, which is soluble in acids.

Tests for Hypophosphites

1. When heated, they evolve spontaneously inflammable hydrogen phosphide.
2. An acid solution of potassium permanganate is decolorized.
3. From solution of mercuric chloride, mercury is precipitated upon the addition of a solution of a hypophosphite.

Official Description.—A translucent, nearly colorless solid, of a waxy luster, having at ordinary temperatures about the consistence of beeswax. By long keeping the surface becomes white or red, and occasionally black.

Odor and Taste.—It has a distinctive and disagreeable odor and taste, *but should not be tasted, except in very dilute solution.*

Tests for Identity.—When exposed to the air, it emits white fumes, which are luminous in the dark, and have an odor somewhat resembling that of garlic; on longer exposure to the air, it often takes fire spontaneously. It melts at about 44° C. (111.2° F.).

Specific Gravity.—About 1.830 at 10° C. (50° F.).

Solubility.—One Gm. dissolves in about 400 mils of dehydrated alcohol, about 17 mils of chloroform, 102 mils of absolute ether, 31.5 mils of benzene, and in 0.9 mil of carbon disulphide at 25° C. (77° F.); sparingly soluble in fixed oils. It is almost insoluble in water, to which it imparts its characteristic disagreeable odor and taste.

Impurities and Tests for Impurities.—*Arsenic.*—Add 1 Gm. of Phosphorus to 10 mils of nitric acid, diluted with 10 mils of distilled water, in a flask having a capacity of 50 mils, and digest the mixture at a gentle heat on a water bath until the Phosphorus is dissolved, passing a current of carbon dioxide into the flask over the surface of the liquid during the heating. Transfer this solution to a dish, evaporate it until nitrous vapors are no longer given off, and then dilute the solution to 250 mils with distilled water. One mil of this solution meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Sulphur.—Add barium chloride T.S. to another portion of the latter solution; not more than a slight opalescence is produced.

U. S. P. Preparation.—Pilulæ Phosphori.

N. F. Preparations.—Elixir Phosphori; Liquor Phosphori; Oleum Phosphoratum.

Uses.—Phosphorus is administered internally, in doses of 1/20 grain (0.0005 Gm.), as a nerve stimulant. Its value in this connection depends upon its being administered in a free state. The oxide of phosphorus, phosphoric acid, does not have the same action; hence all pharmaceutical preparations of phosphorus must be protected from oxidation. (See Pilulæ Phosphori.) In large doses Phosphorus is poisonous.

LIQUOR PHOSPHORI. N. F. Solution of Phosphorus

[**Liq. Phosphor.**—THOMPSON'S SOLUTION OF PHOSPHORUS]

	Metric	Old form
Phosphorus	0.07 Gm.	1¼ grain
Spirit of Peppermint	0.50 mil	10 min.
Glycerin	64.50 mils	2 fl. oz. 278 min.
Dehydrated Alcohol, a sufficient quantity,		
To make	100 mils	4 fl. oz.

Weigh the phosphorus in a dish containing water, which should be counter-balanced after each trial weighing, dry it carefully and quickly with blotting paper and introduce it into a flask containing 35 mils [old form about 1½ fl. oz.] of dehydrated alcohol. Into the neck of the flask insert a perforated cork stopper fitted with a glass tube about 50 cm. [about 20 inches] in length, to serve as a condenser. Place the flask in a water bath and heat it so that the alcohol shall be kept boiling gently, until the phosphorus is dissolved. Allow the solution to cool and then add the spirit of peppermint and glycerin, and sufficient dehydrated alcohol to make the product measure 100 mils [old form 4 fl. oz.]

Average dose.—10 minims (0.6 mil).

QUESTIONS ON SULPHUR AND PHOSPHORUS

Give the symbol and atomic weight of sulphur. (See page 691.)
Where does it come from, and how is it prepared?
What is roll sulphur?
In what forms is sulphur official?
What gas is formed by it in combination with hydrogen?
For what is this gas used?
What are sulphides?
What salts are called sulpho-salts by Berzelius?
What combination does sulphur form with oxygen?
What do these oxides form by their union with water?
Give their formulas in symbols.
What is hyposulphurous acid?
Is there an oxide corresponding to this acid?
What is thiosulphuric acid?
What acids are known as the thionic series of acids?
What are the salts which sulphurous acid forms with bases called, and what are those which are similarly produced from sulphuric acid?
Which are more important salts, sulphates or sulphites?
What are the tests for sulphites and sulphurous acid? For sulphates and sulphuric acid?
What is sublimed sulphur?
What are its physical properties?
In what liquids is sulphur soluble? What tests will identify sublimed sulphur?
Name its official preparations.
How is it used medicinally, and what is the dose?
By what name is it generally known?
What is "flour of sulphur"?
How is washed sulphur prepared?
What is the use of adding ammonia in washing it?
At what temperature does it melt?
How may impurities of free acid be detected? Of arsenic?
Why is washed sulphur preferred for medicinal purposes?
What is the dose?
In what official preparations is it used?
How is precipitated sulphur prepared?
Explain the reaction that takes place between lime and sulphur in the above process.
What would be the result if sulphuric acid were used instead of hydrochloric acid to precipitate the sulphur?
What is the popular name of this preparation?
What would be the result if an excess of hydrochloric acid is added during the precipitation?
How may the following impurities be detected? Free acid; alkalies, nonvolatile residue; arsenic.
For what uses is precipitated sulphur preferable to other forms of sulphur?
Name its official preparations.
What is the dose?
How is sulphur iodide prepared?
What is it called chemically?
Is it a definite chemical compound?
What test will indicate its identity?
What is its use?
Phosphorus—Give symbol and atomic weight.
What is phosphorus, and how is it prepared?
How is acid calcium phosphate obtained?
Explain the reaction which takes place in its formation.
How is red phosphorus, or amorphous phosphorus, obtained?
What are its peculiar properties?
What oxides does phosphorus form with oxygen?
Give their formulas in symbols.

What three acids correspond to phosphoric oxide?
How is orthophosphoric acid formed?
What is its formula in symbols?
How is pyrophosphoric acid obtained?
Give its formula in symbols.
How is metaphosphoric acid obtained?
Give its formula in symbols.
Can phosphorous acid be formed directly from phosphorous oxide?
What is the character of its basicity?
Can hypophosphorous acid be obtained directly from hypophosphorous oxide?
What is the character of its basicity?
What are the tests for phosphates and phosphoric acid?
What are the tests for hypophosphites?
Describe phosphorus. Give identity tests.
What is the specific gravity of phosphorus? What is its melting-point?
How may impurities be detected? Sulphur; arsenic.
Name its official preparations?
What is its medicinal action, and what is the dose?
Upon what does its value depend?
Does phosphoric acid have the same action?
How is solution of phosphorus prepared?
How much phosphorus does it contain?
What is its synonym and dose?

CHAPTER XXXVI

CARBON, BORON, AND SILICON

C; 12.00. B; 11.0. Si; 28.3

THESE three elements present some analogies, and, although the number of pharmaceutical preparations made from them is not great, they are of considerable interest.

Carbon C; 12.00

Unofficial Compounds of Carbon

Carbo Animalis **Animal Charcoal** **U. S. P. VIII**	**Prepared by subjecting bones to a red heat in closed vessels. It is used chiefly as a decolorizing agent.**
Carbon Disulphide (see Chapter LXII)	

Carbon is a very widely diffused element. It is a constituent of all organic substances, and is found in nature in the form of the diamond, graphite, plumbago, coal, etc.

Two compounds with oxygen are known,—carbon dioxide, CO_2, and carbon monoxide, CO.

Carbon dioxide, CO_2, is a colorless, odorless gas with a slightly acid taste, heavier than ordinary air. It is not combustible, and not a supporter of combustion; indeed, it is used extensively as a means of putting out flames, and is generated for that purpose in fire extinguishers and other contrivances of the same character. Some pharmacists have in their cellars a series of pipes fastened to the ceiling with several outlets; a flexible pipe is connected with a soda water tank or cylinder, and thus one may always have a complete fire extinguisher in the cellar; nothing more is necessary to put out a small fire than to turn on the stopcock and close all doors and windows. Water is capable of absorbing its own volume of carbon dioxide, but many times its volume under pressure. This solution was formerly official, under the name of *Aqua Acidi Carbonici*, or carbonic acid water, the well-known "*soda water.*"

Carbonic acid, H_2CO_3, is produced when carbon dioxide is brought into contact with water.

$$\underset{\substack{\text{Carbon}\\\text{Dioxide}}}{CO_2} + \underset{\text{Water}}{H_2O} = \underset{\substack{\text{Carbonic}\\\text{Acid}}}{H_2CO_3}$$

The salts known as carbonates are widely diffused in nature, and many chemical processes are based upon the decomposition of carbonates by strong acids. Carbonic acid, although present everywhere, is one of the weakest inorganic acids known.

Carbon monoxide, CO, is of little interest in pharmacy.

The compounds of carbon and hydrogen are very numerous, and of great importance. They are mostly obtained from organic substances, and these will be considered under Part IV. With nitrogen, carbon forms cyanogen $(CN)_2$, the compound radical of hydrocyanic or prussic acid.

Tests for Carbonates

1. If decomposed by the addition of a strong acid, and the gas passed through lime water, insoluble calcium carbonate is formed.
2. The solutions of many of the salts of the metals, like iron, copper, lead, etc., are precipitated by the soluble carbonates.

CARBO LIGNI. U. S. Wood Charcoal

[Carbo Lig.—Charcoal]

Charcoal prepared from soft wood, and very finely powdered. Preserve it in well-closed vessels.

Preparation.—It is made by burning wood out of contact with air, either in iron cylinders or in stacks. In the former case, the volatile substances resulting from the destructive distillation are collected by condensation, and contribute valuable products to pharmacy (see Acidum Aceticum). In the latter, the charcoal is made in the neighborhood of a cheap wood supply. Billets of wood are piled in a conical form, and covered with earth and sod to prevent the free access of air, several holes being left at the bottom and one at the top of the pile in order to produce a draught to commence the combustion. The wood is kindled from the bottom, and soon after ignition the hole at the top is closed, and when the wood is all ignited the holes at the bottom are stopped. The result is that the combustible portions of the wood, hydrogen, oxygen, water, etc., are dissipated, carbon being left.

Official Description.—Wood charcoal is a black powder, free from gritty matter.

Odor and Taste.—Odorless and tasteless.

Tests for Identity.—It burns without a luminous flame.

Impurities and Tests for Impurities.—Incinerate about 1 Gm. of Charcoal; not more than 7.5 per cent. of ash remains.

Boil about 1 Gm. of Charcoal with a mixture of 3 mils of potassium hydroxide T.S. and 10 mils of distilled water for one-half minute; the filtrate shows only a slight brown color (evidence of *complete carbonization*).

N. F. Preparation.—Trochisci Carbonis Ligni.

Uses.—Charcoal is used in medicine as an absorbent and disinfectant. It is given in the form of powder, in doses of fifteen grains to two drachms (1 to 8 Gm.). Owing to its absorbent powers, it should never be kept exposed to the air, as it will become unfit for use if subjected to the atmosphere of a laboratory or pharmacy. Tin cans with tightly fitting covers are appropriate containers.

Boron B; 11.0

Boron, like carbon, exists in two allotropic conditions,—amorphous and crystalline. Boron combines with hydrogen and oxygen, and boric (or boracic) acid is produced, H_3BO_3, the principal salt of which is sodium borate, or borax.

Tests for Borates and Boric Acid

1. A colorless flame is tinged green by an alcoholic solution of boric acid.

2. A solution of a borate, slightly acidified by hydrochloric acid turns the yellow color of turmeric paper brown, if the paper is allowed to dry.

Unofficial Compounds of Boron

Acidum Metaboricum, HBO_2 Metaboric Acid	By heating boric acid to 38° C. (100° F.)
Acidum Pyroboricum, $H_2B_4O_7$ Pyroboric Acid	By heating boric acid for a long time to 60° C. (140° F.)
Boron Trisulphidum, B_2S_3 Boron Trisulphide	By heating boron in the vapor of sulphur and collecting the resulting white mass

ACIDUM BORICUM. U. S. Boric Acid

[**Acid. Bor.**—Boracic Acid]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99.5 per cent. of H_3BO_3 (62.02).

Preparation.—The lagoons of the volcanic districts of Tuscany formerly furnished the greater part of the boric acid and borax of commerce. Borax is now found native in California and in some of the other Western States, and boric acid is produced by decomposing borax with hydrochloric or sulphuric acid.

$$\underset{\text{Sodium Borate}}{Na_2B_4O_7.10H_2O} + \underset{\substack{\text{Hydrochloric}\\\text{Acid}}}{2HCl} = \underset{\substack{\text{Sodium}\\\text{Chloride}}}{2NaCl} + \underset{\text{Boric Acid}}{4H_3BO_3} + \underset{\text{Water}}{5H_2O}$$

Boric acid is required in very fine, what is known as impalpable, powder for most medical uses.

Official Description.—It occurs in transparent, colorless scales, of a somewhat pearly luster, as six-sided, triclinic crystals, or as a white, bulky powder, slightly unctuous to the touch; permanent in the air.

Odor, Taste, and Reaction.—Odorless; having a faintly bitter taste. An aqueous solution of Boric Acid (1 in 50) is slightly acid to litmus.

Solubility.—One Gm. of Boric Acid dissolves in 18 mils of water, 18 mils of alcohol, and in 4 mils of glycerin at 25° C. (77° F.); also in 4 mils of boiling water and 10 mils of boiling alcohol.

Tests for Identity.—When heated to 100° C. (212° F.), it loses water, forming metaboric acid (hydrogen metaborate, HBO_2), which slowly volatilizes at that temperature.

Heated to about 160° C. (320° F.), Boric Acid fuses to a glassy mass of tetraboric or pyroboric acid (hydrogen tetraborate, $H_2B_4O_7$); at a higher temperature the fused mass swells, loses all of its water, and becomes boron trioxide (B_2O_3), which fuses into a transparent, non-volatile, hygroscopic mass.

Boric Acid volatilizes from a boiling aqueous or alcoholic solution.

Its solution in alcohol or glycerin, when ignited, burns with a flame enveloped by a green mantle.

Turmeric paper moistened with such a solution, to which a little hydrochloric acid T.S. has been added, becomes reddish-brown on drying, this color being changed to greenish-black by ammonia water.

Impurities and Tests for Impurities.—*Heavy Metals.*—An aqueous solution of the Acid does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of Boric Acid meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Dissolve about 2.5 Gm. of Boric Acid, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed, in 50 mils of distilled water and 50 mils of glycerin and titrate with normal sodium hydroxide V.S., phenolphthalein T.S. being used as indicator. It shows, in the dried acid, not less than 99.5 per cent. of H_3BO_3.

Each mil of normal sodium hydroxide V.S. used corresponds to 0.06202 Gm. of H_3BO_3. Each gramme of Boric Acid, previously dried, corresponds to not less than 16.04 mils of normal sodium hydroxide V.S.

U. S. P. Preparations.—Glyceritum Boroglycerini; Unguentum Acidi Borici.

N. F. Preparations.—Cataplasma Kaolini; Liquor Antisepticus; Pulvis Antisepticus; Pulvis Talci Compositus.

Uses.—Boric acid is used in antiseptic surgery, and externally in the form of an ointment which is official. It is added in small quantities to various liquids, to prevent fermentation but its use as a preservative in beverages and foods is prohibited by the Food and Drugs Act and all State laws.

Average dose.—8 grains (0.5 Gm.).

LIQUOR ANTISEPTICUS. N. F. Antiseptic Solution

(Replacing U.S.P. VIII)

[Liq. Antisept.]

	Metric	Old form
Boric Acid	25.0 Gm.	365 grains
Thymol	1.0 Gm.	15 grains
Eucalyptol	5.0 mils	77 minims
Methyl Salicylate	1.2 mils	18.5 minims
Oil of Thyme	0.3 mils	4.5 minims
Menthol	1.0 Gm.	15 grains
Sodium Salicylate	1.2 Gm.	17.5 grains
Sodium Benzoate	6.0 Gm.	88 grains
Alcohol	300.0 mils	9 fl. oz. 288 min.
Purified Talc	20.0 Gm.	5 drachms
Water, a sufficient quantity,		
To make	1000 mils	2 pints

Dissolve the boric acid, sodium benzoate and sodium salicylate in 600 mils [old form 19 fl. oz. 96 minims] of water and the other ingredients in 200 mils [old form 6 fl. oz. 192 minims] of alcohol. Pour the aqueous solution into the alcoholic solution, add the talc and allow the mixture to stand, with occasional agitation, during forty-eight hours. Then filter, returning the first portions of the filtrate until it passes through clear. Add 100 mils [old form 3 fl. oz. 96 minims] of alcohol to the filtrate and then sufficient water to make the product measure 1000 mils [old form 2 pints].

The final addition of alcohol is for the purpose of increasing the alcoholic per cent. of the finished product. The filtrate, before this addition, is saturated, and if the alcoholic per cent. were not increased, the solution, if cooled below the temperature at which it was filtered, would precipitate or become cloudy, chiefly due to the separation of thymol.

Average dose.—1 fluidrachm (4 mils).

LIQUOR ANTISEPTICUS ALKALINUS. N. F. Alkaline Antiseptic Solution

[Liq. Antisept. Alk.]

	Metric	Old form
Potassium Bicarbonate	32.0 Gm.	1 oz. av. 30 gr.
Sodium Benzoate	8.0 Gm.	117 grains
Sodium Borate	32.0 Gm.	1 oz. av. 30 gr.
Thymol	0.2 Gm.	3 grains
Eucalyptol	0.2 mil	3 minims
Oil of Peppermint	0.2 mil	3 minims
Methyl Salicylate	0.4 mil	6 minims
Cudbear	2.0 Gm.	29 grains
Alcohol	60.0 mils	1 fl. oz. 442 min.
Glycerin	150.0 mils	4 fl. oz. 384 min.
Magnesium Carbonate	10.0 Gm.	2½ drachms
Water, a sufficient quantity,		
To make	1000 mils	2 pints

Mix the potassium bicarbonate and sodium borate with 100 mils [old form 3 fl. oz. 96 minims] of water, add the glycerin, and when the effervescence has ceased add the mixture to a solution of the sodium benzoate in 500 mils [old form 1 pint] of water. Dissolve the thymol, eucalyptol, and oils in the alcohol, add the solution of the salts, the cudbear, and sufficient water to make the product measure 1000 mils [old form 2 pints]. Incorporate the magnesium carbonate and allow the mixture to stand with occasional shaking during three days. Finally filter the solution, returning the first portions until the filtrate passes through clear.

Uses.—These solutions were introduced to furnish physicians with formulas for mildly antiseptic solutions which experience has shown to be useful, thereby lessening the difficulty from a lack of uniformity in preparations of this character. The Antiseptic Solution is sometimes given internally in the dose of one fluidrachm (4 mils). The Alkaline Antiseptic Solution is extensively used as a nasal douche and throat gargle.

Silicon Si; 28.3.

Very few of the compounds of the non-metallic element silicon are used medicinally. Silicon, like carbon and boron, is obtained in two allotropic states,—amorphous and crystalline. In some of its combinations, notably in glass, earthenware, china, mortar, and cements of various kinds, it is of vast importance commercially. Silicon is found in nature combined with aluminum, magnesium, or calcium, in *pumice stone, meerschaum, asbestos, talcum, soapstone,* etc.; or as an anhydride (silica), in *sand, flint, agate, quartz,* etc.

Silica, SiO_2, may be obtained in a pure condition by treating a solution of sodium silicate with hydrochloric acid.

$$\underset{\substack{\text{Sodium}\\\text{Silicate}}}{Na_2SiO_3} + \underset{\substack{\text{Hydrochloric}\\\text{Acid}}}{2HCl} = \underset{\text{Silica}}{SiO_2} + \underset{\substack{\text{Sodium}\\\text{Chloride}}}{2NaCl} + \underset{\text{Water}}{H_2O}$$

Test for Silicates

Silicates are insoluble in most reagents. If the soluble sodium and potassium silicates, in aqueous solution, are neutralized with hydrochloric acid, and ammonia water added in excess, a gelatinous precipitate of silicic hydroxide will separate.

Unofficial Compounds of Silicon

Silicon Dioxide, SiO_2, Silica	
Quartz (crystalline) in form of:	Amethyst, a gem. Smoky quartz, a gem Rose quartz, a gem. Granite, building stone Gneiss, building stone. Syenite, building stone Sand, used in the manufacture of pottery, glass, and for many other purposes Pumice stone, volcanic rock. Obsidian, volcanic glass Agate, mortars for chemists' use
Glass	Green Glass made from sand, soda ash, sodium nitrate, lime Blue Glass made from sand, soda ash, sodium nitrate, lime, antimony, manganese, and cobalt Flint Glass made from sand, soda ash, sodium nitrate, lime, antimony, and manganese Opal Glass made from sand, soda ash, sodium nitrate, zinc, fluorspar, cryolite, China clay, antimony, and manganese Amber Glass made from sand, soda ash, lime, salt, and carbon Lead Glass made from sand, soda ash, potash, sodium nitrate, lead, antimony, and manganese
Meerschaum. Magnesium Silicate, Mg_2SiO_3	Used in making tobacco-pipes
Asbestos. Magnesium Silicate	Used for resisting action of fire, or heat
Sodium Silicate Liquor Sodii Silicatis Solution of Sodium Silicate. U. S. P. 1890. (Water Glass)	Made by fusing one part of fine sand and two parts of dried sodium carbonate, mixed in powder, in an earthenware crucible, pouring out the fused mass on a stone slab to cool, powdering, dissolving the soluble matter in boiling water, filtering and concentrating so as to contain about 30 per cent. of sodium silicate. This solution is largely used for the preservation of eggs. The eggs, as fresh as possible, are immersed in a liquid consisting of one volume of the commercial solution and nine volumes of cold, but freshly boiled, water

TALCUM PURIFICATUM. U. S. Purified Talc

[Talc. Purif.]

A purified, native, hydrous magnesium silicate sometimes containing a small amount of aluminum silicate.

Native Talc, also called *French Chalk*, or *Soapstone*, is found in America and other parts of the world; an excellent quality is now obtained from North Carolina.

Preparation.—The U. S. P. VIII gave directions for preparing the purified product as follows: Mix 500 Gm. of powdered native talc with 2500 mils of boiling water, gradually add 50 mils of hydrochloric acid, and boil the mixture during fifteen minutes, then allow it to stand for fifteen minutes. Decant, and reject the supernatant liquid containing the finer particles of talc in suspension, and again boil the residue with 2500 mils of water, mixed with 25 mils of hydrochloric acid, and allow it to stand for fifteen minutes. Again decant, and reject the finer suspended particles, and wash the coarser residue with water by repeated decantation, until a portion of the wash-water, after filtering and acidifying with nitric acid, fails to become opalescent upon the addition of silver nitrate T.S. Then transfer the magma to a close linen or muslin strainer, allow it to drain, and dry it at 110° C. (230° F.).

Talc, as found in commerce, contains the impurities usually associated with native mineral substances. When treated with hydrochloric acid and water, as in this process, aluminum, iron, and magnesium salts are removed.

Official Description.—A very fine, white or grayish-white powder, which adheres to the skin, is quite free from grittiness and is slippery to the touch.

Odor and Taste.—Odorless and tasteless.

Tests for Identity.—Mix 0.5 Gm. of Purified Talc with about 2 Gm. each of anhydrous sodium and potassium carbonates, heat the mixture in a platinum crucible until fusion is complete, and treat the resulting fused mass with hot distilled water. Then neutralize the liquid with diluted sulphuric acid, add 10 mils more of the diluted acid and evaporate the mixture until white fumes of sulphuric acid anhydride are evolved. Add 20 mils of distilled water, boil the mixture and filter; an insoluble residue of *silica* remains. The addition of ammonia water and ammonium chloride to the filtrate may produce a white gelatinous precipitate of *aluminum hydroxide*, and the filtrate from this mixture on the addition of sodium phosphate T.S. yields a white crystalline precipitate of magnesium ammonium phosphate.

Impurities and Tests for Impurities.—When subjected to ignition at red heat, it loses not more than 5 per cent. of its weight.

Soluble Substances.—Boil 10 Gm. of Purified Talc with 50 mils of distilled water for one-half hour, adding water from time to time to maintain approximately the original volume. It yields a filtrate which is neutral to litmus, and one-half of this filtrate, when evaporated and dried at 110° C. (230° F.), yields not more than 0.005 Gm. of residue.

Iron.—The remaining half of this filtrate, after slightly acidulating with hydrochloric acid, does not yield a blue color upon the addition of potassium ferrocyanide T.S.

Note.—Purified Talc, when used as a filtering medium, should not be finer than a No. 100 powder.

U. S. P. Preparations.—Filtering medium in aromatic waters, syrups, etc.

N. F. Preparations.—Pulvis Talci Compositus; also used as a filtering medium.

Uses.—Purified Talc is used as a distributing and filtering medium in making medicated waters, elixirs, etc.

It is also used extensively when perfumed or medicated as a toilet powder under the name *Talcum Powder.* For toilet purposes it should be in the form of an impalpable powder but when used as a filtering medium, the Pharmacopœia directs that it should not be finer than a No. 100 powder. The coarser powder is directed because the impalpable form passes through the pores of the filter paper and contaminates the filtrate.

TERRA SILICEA PURIFICATA. U. S. Purified Siliceous Earth

[Ter. Sil. Purif.—Purified Kieselguhr Purified Infusorial Earth]

A form of silica ($SiO_2 = 60.30$) consisting of the frustules and fragments of diatoms, purified by boiling with diluted hydrochloric acid, washing and calcining. It does not contain more than 10 per cent. of moisture. Preserve it in tightly-closed containers.

Large deposits of this substance are found in Virginia, Maryland, Nevada, Oregon, and California, usually in the form of masses of rocks, hundreds of feet in thickness. Under the microscope it is seen to consist largely of the minute siliceous structure of diatoms. It must be carefully purified in a manner similar to that directed for talc (see above) and thoroughly calcined, the latter treatment destroying the bacteria which are present in large quantities in the native earth.

Official Description.—A very bulky and very fine powder, white or of a pale light gray or pale buff color. It readily absorbs moisture and will retain about four times its weight of water without the mixture becoming fluid.

Odor, Taste, and Reaction.—Without odor or taste. Boil 10 Gm. of Purified Siliceous Earth with 50 mils of distilled water and filter the mixture; the filtrate is colorless and neutral to litmus.

Solubility.—Insoluble in water, acids or dilute alkaline solutions.

Impurities and Tests for Impurities.—*Moisture.*—When ignited its color is not darkened (organic impurities) nor does it lose more than 10 per cent. of its weight.

Carbonate.—Add 1 Gm. of Purified Siliceous Earth to 25 mils of diluted hydrochloric acid; no effervescence occurs and

Sulphate.—After boiling and filtering, the filtrate is colorless, and separate portions, when tested, yield no precipitate with barium chloride T.S. and

Iron.—No blue color with potassium ferrocyanide T.S.

Acid Soluble Impurities.—Digest 1 Gm. of Purified Siliceous Earth, for fifteen minutes, with 20 mils of diluted hydrochloric acid and filter. Ten mils of the filtrate, when evaporated to dryness and ignited, does not leave a residue weighing more than 0.005 Gm.

U. S. P. Preparation.—Filtering medium in aromatic waters.

N. F. Preparation.—Pasta Zinci Sulphurata.

Uses.—It has been introduced into the Pharmacopœia as a distributing and filtering medium for aromatic waters. It is better adapted for the filtration of elixirs. The native Infusorial Earth is extensively used in metal polishing powders and pastes and as an absorbent for nitroglycerin to produce the explosive known as dynamite.

KAOLINUM. N. F. Kaolin

(U.S.P. VIII)

A native hydrated aluminum silicate, powdered and freed from gritty particles by elutriation.

The name *Kaolin* is derived from the Chinese word "kaoling," meaning "high ridge"; it is sometimes called *China clay*, or *porcelain clay*, because of its use in pottery, and it is a valuable commercial product. Besides aluminum silicate, it often contains small quantities of aluminum hydroxide, ferric oxide, magnesium oxide, and calcium carbonate. For pharmaceutical purposes it should be purified by treatment with hydrochloric acid if calcium carbonate is present, and afterwards with diluted sulphuric acid to remove the other impurities; the kaolin should be thoroughly washed with water to remove the chlorides and sulphates.

Official Description.—A soft, white or yellowish-white powder, or in lumps.

Solubility.—Insoluble in water, and in cold dilute acids and solutions of the alkali hydroxides.

Odor, Taste, and Reaction.—It has an earthy or clay-like taste. When moistened with water, Kaolin assumes a darker color and develops a marked clay-like odor.

Tests for Identity.—Mix 1 Gm. of Kaolin with 10 mils of distilled water and 5 mils of sulphuric acid in a porcelain dish; no effervescence occurs. Evaporate the mixture until the excess of water is removed, and further heat the residue until dense white fumes of sulphuric anhydride appear, then add 20 mils of distilled water, boil for a few minutes and filter; there remains on the filter a gray residue of impure silica.

To one-half of the filtrate just obtained add ammonia water; a gelatinous precipitate of aluminum hydroxide is obtained which is insoluble in an excess of the reagent.

To the remaining half of the filtrate add sodium hydroxide T.S.; a gelatinous precipitate is produced which is completely or almost completely soluble in an excess of the reagent.

Impurities and Tests for Impurities.—*Iron.*—Rub 2 Gm. of Kaolin in a mortar with 10 mils of distilled water; the mixture does not acquire more than a slight reddish tint on the addition of 0.5 Gm. of sodium salicylate.

Ignite Kaolin at a red heat; not less than 85 per cent. of a non-volatile residue remains.

N. F. Preparation.—Cataplasma Kaolini.

Uses.—Kaolin forms the solid basis for the cataplasm of kaolin (Cataplasma Kaolini), and when purified it has been used as an absorbent in making medicated waters, but must never be used as a filtering agent for liquids containing alkaloids, as it has been shown that it combines with alkaloids, separating them completely from the liquids filtered.

QUESTIONS ON CARBON, BORON, AND SILICON

Carbon—Give symbol and atomic weight. (See page 702.)
In what forms is carbon found in nature?
What compounds with oxygen are known? Give their formulas.
What are the physical properties of carbon dioxide?
What is carbonic acid? Is it a strong acid?
What is carbon monoxide?
What is cyanogen?
What are the tests for carbonates?
How is charcoal prepared?
From what kind of wood should it be made? How much ash should remain on incineration?
What is its medicinal use? What is the dose?
Boron—Give symbol and atomic weight.
In what forms does boron exist?
What combination of it is formed with oxygen and hydrogen?
What are the tests for borates and boric acid?
What is boric acid? What is its synonym? Give symbol and atomic weight.
How is it prepared? Where does it come from?
What chemical reaction takes place when borax is decomposed by hydrochloric acid?
What is the solubility of boric acid in water? How much would be used to make one fluidounce of a saturated aqueous solution? Give several identity tests.
How may the following impurities be detected? Heavy metals; arsenic.
Name its official preparations.
What are the uses of boric acid?
What are the ingredients in antiseptic solution?
Why is 100 mils of alcohol reserved, in preparing the solution of the oils, and afterwards added directly to the clear filtrate?
For what is this solution used?
Name the ingredients in alkaline antiseptic solution. For what is it used?
Silicon—Give symbol and atomic weight.
In what forms is silicon obtained?
In what combinations is it important, commercially?
How is it found in nature?
What is silica, and how may it be obtained pure?
Give the chemical reaction when a solution of sodium silicate is treated with hydrochloric acid.
What are the tests for silicates?
What is purified talc?
How may it be prepared? Give a description. What impurities are likely to be present?
Why is a powder of less than No. 100 directed when talc is to be used as a filtering agent?
What are the uses of talc?
Define purified siliceous earth? Give the synonyms. Where is it found and how purified? Why is it necessary to calcine the official product? Give its uses.
What is kaolin? How may it be purified for pharmaceutical purposes?
What impurities must be guarded against?
For what is it used?
Is this a desirable substance to use as a filtering medium for liquids containing alkaloids? Why?

CHAPTER XXXVII

THE ALKALIES AND THEIR COMPOUNDS

Potassium, Sodium, Lithium, and Ammonium

K; 39.10. Na; 23.00. Li; 6.94. NH_4; 18.04

THE alkalies are bodies having strongly marked physical and chemical properties: 1. They combine with acids to form salts. 2. They restore the color of reddened litmus paper, and change the colors of vegetable blues to green, and of vegetable yellows to brown. 3. Their taste is never sour, but it is characteristic, and caustic if the alkali is in concentrated solution. The salts formed by their combinations with acids possess acid, alkaline, or neutral reactions according to the relative strength and proportion of the component parts.

The metals known as alkali metals, which form compounds of pharmaceutical interest, are potassium, sodium, and lithium. Chemically *Rubidium* and *Cæsium* are also classed with this group, but having no pharmaceutical interest they will be given no detailed consideration. The three important alkali metals, potassium, sodium, and lithium, are all univalent, and of a white color resembling that of silver, and are so prone to oxidation that they must be kept constantly immersed in some hydrocarbon or body free from oxygen, like naphtha or petroleum. They are so soft that they can be easily cut with a penknife. They float upon water, and inflame spontaneously and immediately when brought in contact with it, causing decomposition of the water with the evolution of hydrogen and the production of the hydroxide of the metal.

The alkali metals are often called light metals, on account of their low specific gravity when compared with the others.

Their carbonates are all soluble in water, and each metal forms but one chloride.

Their oxides are strongly basic, quickly changing the color of red litmus to blue. The oxides are also very soluble in water, forming caustic and powerfully alkaline hydroxides, which cannot be decomposed by heat.

Their sulphates, phosphates, nitrates, sulphides, chlorides, bromides, iodides, and nearly all their salts, are soluble in water, are almost without exception colorless, or of an opaque white color, and many of them, if heated to redness, fuse without decomposition.

The processes for obtaining the metals are very similar, and formerly consisted in exposing their carbonates, intimately mixed with finely powdered charcoal, in suitable iron vessels, to an intense heat; carbon monoxide is liberated, and the vapors of the metals are condensed in flattened receivers. They are also largely made by electrolysis by subjecting the alkali hydroxide to a strong electric current.

Ammonium is a compound radical, NH_4, but has so many analogies with the alkali metals that it is classed with them.

CHAPTER XXXVIII

THE POTASSIUM SALTS

The salts of potassium are among the most important of any that are used in medicine. They are generally very soluble, and, with a few exceptions, are colorless or of an opaque white color. The sole source of the potassium salts was formerly wood ashes, but at present cheaper sources have been discovered. The wood ashes were lixiviated, the liquid containing the soluble salts evaporated to dryness, and the residue allowed to cool. This constituted the crude *potash* of commerce.

Potash is now made from the ashes from beet sugar residues, from *suint,* the residue obtained by evaporating the water used to scour the fleeces of sheep, and from impure potassium chloride and potassium sulphate obtained from the Stassfurt mines in Germany, which is now the principal source of the potassium compounds.

The impure salts of potash, as obtained from the various sources, may be simply purified or they may be passed through suitable chemical processes for the production of the several official salts. These detailed processes will be found under each title.

Tests for Potassium Salts

Potassium may be recognized in its combinations by the following tests:

1. The addition of platinic chloride with a little alcohol and a few drops of hydrochloric acid produces a yellow crystalline precipitate, $PtCl_4 2KCl$ (double platinum and potassium chloride).
2. Chloroplatinic acid, H_2PtCl_6, yields a yellow crystalline precipitate of potassium chloroplatinate, K_2PtCl_6, which is only slightly soluble in water and less soluble in alcohol.
3. With an excess of concentrated solution of tartaric acid, a white crystalline precipitate is slowly formed when a strong solution of a potassium salt is added with stirring. This is the well-known acid potassium tartrate (cream of tartar).
4. A colorless flame is tinted violet by pure potassium salts.
5. Potassium salts are soluble in water, and not volatile at a red heat.

U. S. P. Potassium Salts

Official Name	Preparation
With Inorganic Radicals	
Potassa Sulphurata	By melting potassium hydroxide and sulphur together in a crucible, pouring the liquid on a slab and cooling
Potassii Bicarbonas	By passing carbon dioxide into a solution of carbonate, evaporating and crystallizing
Bromidum	By treating solution of potassium hydroxide with bromine and charcoal
Carbonas	By purifying pearlash by dissolving it in water, filtering, evaporating, and granulating
Chloras	By reacting on potassium chloride with calcium hypochlorite and by electrolysis

U. S. P. Potassium Salts—*Continued*

Official Name	Preparation
With Inorganic Radicals	
Hydroxidum	From the ashes of plants, etc., by lixiviating, concentrating the solutions, evaporating to dryness, purifying by treating a diluted solution with lime, evaporating, fusing, and casting into moulds; also prepared by electrolytic methods from potassium chloride
Hypophosphis	By precipitating calcium hypophosphite with potassium carbonate
Iodidum	By treating solution of potassium hydroxide with iodine, evaporating to dryness, and heating with charcoal
Nitras	By decomposition of sodium nitrate with potassium chloride
Permanganas	By heating together manganese dioxide, potassium chlorate, and potassium hydroxide
With Organic Radicals	
Potassii Acetas	By decomposing potassium bicarbonate with acetic acid, and evaporating the filtered solution, carefully avoiding contact with iron
Bitartras	By purifying argol, the sediment deposited in wine casks during fermentation
Citras	By decomposing potassium bicarbonate with citric acid, evaporating and granulating
Citras Effervescens	By mixing finely powdered potassium citrate, sodium bicarbonate, tartaric acid, and citric acid, heating the mixture until it becomes uniformly moist, granulating, and drying
et Sodii Tartras	By treating solution of potassium bitartrate with sodium carbonate

N. F. Potassium Salts

Potassa cum Calce	By mixing equal parts of well dried potassium hydroxide and lime
Potassii Chloridum	Purified from natural deposits from the Stassfurt mines and obtained as a by-product in the manufacture of other salts.
Sulphas	Obtained by purifying natural deposits and also as a by-product from nitric acid manufacture

Official Preparations Containing Potassium Salts

These will be found enumerated under the various salts which follow:

Unofficial Potassium Salts and Preparations

Potassii Antimonias, $KSbO_3$ Potassium Antimoniate	Deflagrating 1 part metallic antimony with 4 parts potassium nitrate, and lixiviating with water
Potassii Bisulphas, $KHSO_4$ Potassium Bisulphate	Residue remaining in retort on preparing nitric acid from potassium nitrate and sulphuric acid
Potassii Bisulphis, $KHSO_3$ Potassium Bisulphite	Passing an excess of sulphurous acid gas into a concentrated solution of potassium carbonate
Potassii Borotartras Potassium Borotartrate	Dissolve by heat 4 parts potassium bitartrate, and 1 part boric acid in 10 parts water, and evaporate to dryness
Potassii Chromas, K_2CrO_4 Potassium Chromate	Add potassium carbonate to a hot solution of potassium dichromate until effervescence ceases
Potassii Cyanidum, KCN, U. S. P. VIII Potassium Cyanide	By fusing potassium ferrocyanide with potassium carbonate, separating the insoluble precipitate of metallic iron, and pouring the fused mass on a slab
Potassii et Ammonii Tartras, $KNH_4C_4H_4O_6$ Potassium and Ammonium Tartrate	Diffuse 1 part potassium bitartrate in 3 parts boiling water; then add ammonium carbonate until effervescence ceases; filter and crystallize
Potassii et Sodii Borotartras Potassium and Sodium Borotartrate	Dissolve 2 parts sodium borate in 20 parts distilled water, and digest with 5 parts potassium bitartrate
Potassii Dichromas, $K_2Cr_2O_7$, U. S. P. VIII Potassium Dichromate	By treating potassium chromate with sulphuric acid, evaporating and crystallizing
Potassii Ferricyanidum, $K_3Fe(CN)_6$ Potassium Ferricyanide	Pass chlorine gas into a cold solution of potassium ferrocyanide until it ceases to produce a blue precipitate with ferric chloride
Potassii Ferrocyanidum, $K_4Fe(CN)_6+3H_2O$ Potassium Ferrocyanide. U. S. P. VIII	By heating nitrogenized substances with iron and potassium hydroxide
Potassii Iodas, KIO_3 Potassium Iodate	Pass chlorine gas into cold water containing iodine in suspension until wholly dissolved; then add potassium chlorate and warm. Dose, 6 to 8 grains (0.38 to 0.5 Gm.)
Potassii Iodohydrargyras, $(2KI.HgI_2)3H_2O$ Potassium Iodohydrargyrate (Potassio-Mercuric Iodide)	Dissolve 3 parts mercuric iodide in a concentrated solution of potassium iodide containing 2 parts of the salt; when cool, yellow prisms will deposit from the mother liquor. Dose, one-twelfth of a grain (0.005 Gm.)

Unofficial Potassium Salts and Preparations—*Continued*

Potassii Nitris, KNO_2 Potassium Nitrite	Made by heating the nitrate to redness and separating undecomposed nitrate; by dissolving the fused mass in water, the nitrate will crystallize out.
Potassii Perchloras, $KClO_4$ Potassium Perchlorate	Heat potassium chlorate until it melts; keep at this temperature until gas ceases to be evolved, and a portion tested with strong HCl acquires only a faint yellow color. Purify
Potassii Platinocyanidum, $2KCN.Pt(CN)_2.3H_2O$ Potassium Platinocyanide	Mix concentrated solutions of 1 part exsiccated platinic chloride and 2 parts potassium cyanide; heat until the precipitate is redissolved
Potassii Pyrosulphis, $K_2(SO)_2O$ Potassium Pyrosulphite	Pass sulphurous acid gas into a warm, saturated solution of potassium carbonate; on cooling, it deposits crystals
Potassii Salicylas, $KC_7H_5O_3$ Potassium Salicylate	Dissolve 7 parts potassium bicarbonate in water; then add gradually 10 parts salicylic acid, and evaporate
Potassii Silicas, K_2SiO_3 Potassium Silicate Soluble Glass	Fuse 10 parts potassium carbonate, 15 parts fine sand, and 1 part charcoal
Potassii Sulphidum, K_2S Potassium Sulphide	Pass hydrogen sulphide gas into a solution of potassium hydroxide as long as it is absorbed, and add an equal bulk of potassium hydroxide solution; evaporate
Potassii Sulphis, $K_2SO_3+2H_2O$ Potassium Sulphite	Pass sulphurous acid gas through a solution of potassium carbonate
Potassii Sulphocarbonas, K_2CS_3 Potassium Sulphocarbonate	Mix a solution of potassium sulphide with carbon disulphide; on evaporation, orange-yellow crystals are deposited
Potassii Sulphocyanas, KCNS Potassium Sulphocyanate	Melt together 17 parts potassium carbonate, 32 parts sulphur, and 46 parts anhydrous potassium ferrocyanide, and heat to low redness. When cool, treat with boiling alcohol
Potassii Tartras $K_2C_4H_4O_6+\frac{1}{2}H_2O$ Potassium Tartrate	By treating solution of potassium bitartrate with potassium carbonate
Mistura Potassii Citratis. U. S. P. 1880 Neutral Mixture	By neutralizing 100 parts of lemon juice with 10 parts of potassium bicarbonate

POTASSA SULPHURATA. U. S. Sulphurated Potassa
[Pot. Sulphurat.—LIVER OF SULPHUR]

A mixture composed chiefly of potassium polysulphides and potassium thiosulphate and containing an amount of sulphides corresponding to not less than 12.8 per cent. of sulphur (S). Preserve it in well-closed containers.

Preparation.—Sulphurated Potassa may be prepared by thoroughly mixing 1 part of sublimed sulphur with 2 parts of potassium carbonate and gradually heating the mixture in a covered iron crucible until the mass ceases to swell and is completely melted. It is then poured on a stone or glass slab and when cold broken into pieces and preserved in tightly closed bottles. When the heat is properly regulated during its production the reaction is approximately as follows:

$$\underset{\text{Potassium Carbonate}}{3K_2CO_3} + \underset{\text{Sulphur}}{4S_2} = \underset{\text{Potassium Trisulphide}}{2K_2S_3} + \underset{\text{Potassium Thiosulphate}}{K_2S_2O_3} + \underset{\text{Carbon Dioxide}}{3CO_2}$$

The Trisulphide is considered the most advantageous form.

As this product rapidly deteriorates through the absorption of moisture, oxygen, and carbon dioxide, it is desirable for the prescription pharmacist to prepare it frequently to secure satisfactory preparations.

Official Description.—In irregular pieces, liver-brown when freshly made, changing to greenish-yellow and finally to gray through absorption of moisture, oxygen, and carbon dioxide from the air.

Odor, Taste, and Reaction.—It has a strong odor of hydrogen sulphide and a bitter, acrid, and alkaline taste; strongly alkaline to litmus when in aqueous solution.

Solubility.—Very soluble in water, usually leaving a slight residue. Alcohol dissolves only the sulphides.

Tests for Identity.—An aqueous solution of Sulphurated Potassa (1 in 10) is light brown in color. The addition of an excess of acetic acid to this solution causes a brisk evolution of hydrogen sulphide and a precipitation of sulphur. In the liquid thus treated, after filtration, an excess of sodium bitartrate T.S. produces an abundant, white crystalline precipitate on standing.

Assay.—Add a solution of 1 Gm. of crystallized copper sulphate in 15 mils of distilled water to a solution of 1 Gm. of Sulphurated Potassa in 10 mils of distilled water, shake the mixture in a stoppered vessel for a few minutes and filter. The filtrate, acidulated with acetic acid and filtered if necessary, produces no black precipitate with an equal volume of hydrogen sulphide T.S., corresponding to not less than 12.8 per cent. of sulphur combined as sulphides.

Uses.—It is extensively used in dermatologic practice, especially in what is commonly known as *Lotio Alba* or *White Lotion.* (See Formulary, Part VI.) The reaction of the potassium trisulphide in preparing white lotion is as follows:

$$\underset{\substack{\text{Zinc}\\\text{Sulphate}}}{ZnSO_4} + \underset{\substack{\text{Potassium}\\\text{Trisulphide}}}{K_2S_3} = \underset{\substack{\text{Zinc}\\\text{Sulphide}}}{ZnS} + \underset{\text{Sulphur}}{S_2} + \underset{\substack{\text{Potassium}\\\text{Sulphate}}}{K_2SO_4}$$

The mixture of insoluble zinc sulphide and sulphur gives it the creamy white appearance and the potassium sulphate goes into solution. Even weak acids cause the liberation of H_2S from sulphurated potassa.

POTASSII HYDROXIDUM. U. S. Potassium Hydroxide [Pot. Hydrox.—Caustic Potash Potassium Hydrate]

It contains not less than 85 per cent. of KOH (56.11). Preserve it in well-closed containers. If bottles are used they must be made of hard glass.

Preparation.—It is prepared by adding milk of lime or calcium hydroxide to a hot solution of potassium carbonate, decanting the KOH solution from the precipitated calcium carbonate and concentrating it. It is also prepared on a large scale by electrolytic methods through the decomposition of potassium chloride, chlorine gas being the other product of the reaction. Potassium Hydroxide, called commercially caustic potash, is prepared in the form of sticks by evaporating a solution of potassium hydroxide rapidly in a silver or clean iron vessel until a fluid of oily consistence remains, a drop of which, when removed on a warm glass rod, solidifies on cooling. The hot caustic is poured into cylindrical moulds, and while the sticks are still warm they are bottled quickly, to prevent deliquescence.

Pure caustic potassium hydroxide is sometimes prepared in the form of powder by stirring the fused mass rapidly with a silver spatula until a granulated powder is formed. This must be placed in warm dry bottles and quickly sealed hermetically.

Potassa by Alcohol and *Potassa by Barytes* are terms used to designate pure caustic Potassium Hydroxide made by purifying with alcohol and barium hydroxide, alcohol dissolving only the potassium hydroxide, while the sulphate is separated by treatment with baryta water, forming the insoluble barium sulphate.

Official Description.—It occurs as dry, white, or nearly white, fused masses, or sticks, hard and brittle, showing a crystalline fracture.

Odor and Reaction.—Odorless. An aqueous solution of Potassium Hydroxide even when greatly diluted is strongly alkaline to litmus. *Great caution is necessary in handling it,* as it rapidly destroys organic tissues. When exposed to the air, it readily absorbs carbon dioxide and moisture, and deliquesces.

Solubility.—One Gm. of Potassium Hydroxide dissolves in 0.9 mil of water, about 3 mils of alcohol, and in 2.5 mils of glycerin at 25° C. (77° F.), also in 0.6 mil of boiling water; very soluble in boiling alcohol.

Tests for Identity.—When introduced into a non-luminous flame, it imparts to it a violet color. An aqueous solution of Potassium Hydroxide (1 in 10), when added to an excess of tartaric acid T.S., produces a white, crystalline precipitate, which redissolves when the Potassium Hydroxide is added in excess.

Impurities and Tests for Impurities.—*Organic matter or insoluble impurities.* An aqueous solution of Potassium Hydroxide (1 in 20) is clear and colorless.

Heavy Metals.—An aqueous solution of Potassium Hydroxide (1 in 50), slightly acidulated with hydrochloric acid, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dissolve in a 500 mil graduated flask about 10 Gm. of Potassium Hydroxide, accurately weighed in a glass-stoppered weighing-bottle, in 250 mils of distilled water, which has previously been boiled and cooled, and add 30 mils of barium chloride T.S. Now fill the flask to the mark with distilled water, which has previously been boiled and cooled, and thoroughly agitate the liquid. Then filter the liquid in the flask through a dry filter into a dry flask, rejecting the first 20 mils, and titrate 200 mils of the clear filtrate with normal hydrochloric acid V.S., using phenolphthalein T.S. as indicator. It shows not less than 85 per cent. of KOH when calculated to the amount originally taken.

Each mil of normal hydrochloric acid V.S. used corresponds to 0.05611 Gm. of KOH. Each gramme of Potassium Hydroxide corresponds to not less than 15.15 mils of normal hydrochloric acid V.S.

U. S. P. Preparations.—Liquor Cresolis Compositus, Liquor Potassii Hydroxidi; Sapo Mollis.

N. F. Preparations.—Liquor Picis Alkalinus; Potassa cum Calce.

The U. S. P. IX assay estimates only the KOH, as any carbonates present are precipitated by the preliminary treatment with barium chloride.

Uses.—Potassium Hydroxide is used as a caustic, principally in veterinary practice; the end of the stick may be inserted into a section of rubber tubing, or wrapped several times with tin foil, to avoid cauterizing the finger of the operator. Allowance should be made for the moisture usually present in commercial caustic potash as it rarely contains less than 30 per cent.

LIQUOR POTASSII HYDROXIDI. U. S. Solution of Potassium Hydroxide

[Liq. Pot. Hydrox.—LIQUOR POTASSÆ SOLUTION OF POTASSA]

An aqueous solution containing not less than 4.5 per cent. of KOH (56.11). Preserve Solution of Potassium Hydroxide in bottles made of hard glass, and provided with rubber stoppers or with glass stoppers coated with petrolatum.

	Metric	Old form
***Potassium Hydroxide**	60 Gm.	1 oz. av. 20 gr.
Distilled Water	940 Gm.	15 fl. oz.
To make	1000 Gm.	1 pint

Dissolve the potassium hydroxide in the distilled water.

The potassium hydroxide used in this process should be of the full strength and quality directed by the Pharmacopœia (85 per cent.). Potassium hydroxide of any other strength, however, may be used, if a proportionately larger or smaller quantity be taken; the proper amount for the above formula being ascertained by dividing 5100 by the percentage of absolute potassium hydroxide contained therein.

Solution of Potassium Hydroxide was formerly made by decomposing 85 Gm. of potassium bicarbonate through the action of 40 Gm. of lime slaked with 20 mils of water with heat. The mixture was made up to 1000 Gm. and the clear solution decanted. The direction to heat the solution of potassium bicarbonate until effervescence ceases was for the purpose of driving off as much of the carbonic acid as possible by the simplest method; the remainder was disposed of through double decomposition, as shown by the equation

$$\underset{\text{Potassium Carbonate}}{K_2CO_3} + \underset{\text{Calcium Hydroxide}}{Ca(OH)_2} = \underset{\text{Potassium Hydroxide}}{2KOH} + \underset{\text{Calcium Carbonate}}{CaCO_3}$$

Preference was given to the bicarbonate as the source of the potassium, because the cheaper carbonates nearly always contain silicates and other impurities in sufficient quantities to render the product inferior.

In making this solution in this way, the proportion of water is not a matter of indifference. The quantity used should be at least five times as great as that of the bicarbonate, and the lime must greatly exceed the amount indicated by theory.

Official Description.—A clear, colorless liquid.

Odor, Taste, and Reaction.—Odorless, having, even when diluted, a very acrid and caustic taste. *It should not be tasted unless largely diluted.* It is strongly alkaline and readily absorbs carbon dioxide from the air.

Specific Gravity.—About 1.046 at 25° C. (77° F.).

Tests for Identity.—It conforms to the reactions and tests for an aqueous solution of potassium hydroxide as given under *Potassii Hydroxidum*, when concentrated to the proper strength.

Impurities and Tests for Impurities.—*Carbonate.* Introduce about 20 mils of Solution of Potassium Hydroxide into a flask, stopper, weigh accurately and titrate it directly with normal hydrochloric acid V.S., using methyl orange T.S. as indicator. It shows not more than 5.5 per cent. of alkalinity, calculated as KOH.

Assay.—Transfer about 50 mils of Solution of Potassium Hydroxide, accurately weighed, to a 250 mil measuring flask, add 20 mils of barium chloride T.S. and fill the flask to the mark with distilled water, which has previously been boiled and cooled. Then thoroughly agitate the liquid, filter it through a dry filter, reject the first 20 mils and titrate 100 mils of the filtrate, representing 20 mils of the solution, with normal hydrochloric acid V.S., using phenolphthalein T.S. as indicator. It shows not less than 4.5 per cent. of KOH, when calculated to the amount of solution originally taken.

Each mil of normal hydrochloric acid V.S. used corresponds to 0.05611 Gm. of KOH. Each gramme of Solution of Potassium Hydroxide (after treatment with barium chloride T.S.) corresponds to not less than 0.80 mil of normal hydrochloric acid V.S.

Uses.—Solution of potassium hydroxide is a valuable antacid when given in doses of fifteen minims (1 mil), diluted with milk. If a large quantity should be swallowed accidentally, the proper antidotes would be mild acid liquids, like vinegar or lemon juice, accompanied with bland oils.

POTASSII ACETAS. U. S. Potassium Acetate

[Pot. Acet.]

It contains, when dried to constant weight at 150° C (302° F.) not less than 99 per cent. of $KC_2H_3O_2$ (98.12). Preserve it in air-tight containers.

Preparation.—This salt may be made by adding crystals of potassium bicarbonate to pure acetic acid until effervescence ceases, and, after acidulating slightly with a few drops of the acid, cautiously evaporating to dryness in a porcelain evaporating dish by means of a sand-bath. Great care is necessary to avoid contamination with iron, and it is not safe to use an enameled iron dish.

$$\underset{\text{Potassium Bicarbonate}}{KHCO_3} + \underset{\text{Acetic Acid}}{HC_2H_3O_2} = \underset{\text{Potassium Acetate}}{KC_2H_3O_2} + \underset{\text{Carbon Dioxide}}{CO_2} + \underset{\text{Water}}{H_2O}$$

The manufacturer nearly always uses the carbonate in making potassium acetate, instead of the bicarbonate, because it is much cheaper. The product from the carbonate is apt to be impure, however, because of the silica, sulphate, chlorides, etc., always present in the ordinary carbonate.

Official Description.—A white powder, or in crystalline masses of a satin-like luster, very deliquescent on exposure to the air.

Odor, Taste, and Reaction.—Odorless, or with a faint, acetous odor, and having a warming, saline taste. An aqueous solution of the salt (1 in 20) is alkaline to litmus, but does not affect phenolphthalein T.S.

Solubility.—One Gm. of Potassium Acetate dissolves in 0.5 mil of water and in 2.9 mils of alcohol at 25° C. (77° F.); also in about 0.2 mil of boiling water.

Tests for Identity.—When slightly heated, the salt fuses. On strong ignition it is decomposed with the evolution of inflammable empyreumatic vapors and leaves a black residue of potassium carbonate and carbon. This residue imparts to a non-luminous flame a violet color, is alkaline to litmus, and effervesces with acids.

The addition of 5 mils of sodium bitartrate T.S. to 5 mils of an aqueous solution of the salt (1 in 5) causes a white, crystalline precipitate.

Add 0.1 Gm. of the salt to 1 mil of sulphuric acid and 1 mil of alcohol and gently warm the mixture; ethyl acetate is formed, recognizable by its odor.

Impurities and Tests for Impurities.—*Heavy Metals.*—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of the salt meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Dry the salt to constant weight at 150° C. (302° F.) and proceed as directed under the Assay for alkali salts of organic acids (see U. S. P., Test No. 6, Chapter LXII). It shows, in the dried salt, not less than 99 per cent. of $KC_2H_3O_2$.

Each mil of half-normal sulphuric acid V.S. used corresponds to 0.04906 Gm. of $KC_2H_3O_2$. Each gramme of Potassium Acetate, previously dried, corresponds to not less than 20.2 mils of half-normal sulphuric acid V.S.

N. F. Preparations.—Elixir Buchu et Potassii Acetatis; Elixir Potassii Acetatis, Elixir Potassii Acetatis et Juniperi.

Uses.—Potassium acetate is a reliable diuretic when given in doses of fifteen grains to one drachm (1 to 4 Gm.). In larger doses it acts as a cathartic.

POTASSII BICARBONAS. U. S. Potassium Bicarbonate

[Pot. Bicarb.]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99 per cent. of $KHCO_3$ (100.11). Preserve it in well-closed containers.

Preparation.—This salt is made by passing carbon dioxide through a solution of potassium carbonate until it is fully saturated, then filtering the liquid, and evaporating at a temperature below 71° C. (160° F.) to prevent decomposition. The crystals formed should be well washed and dried.

$$\underset{\text{Potassium Carbonate}}{K_2CO_3} + \underset{\text{Carbon Dioxide}}{CO_2} + \underset{\text{Water}}{H_2O} = \underset{\text{Potassium Bicarbonate}}{2KHCO_3}$$

The cheapest way to make this salt is to suspend a dish containing a concentrated solution of potassium carbonate within the fermenting tuns of a brewery; the carbon dioxide produced during fermentation is thus utilized. The crude salt obtained on evaporation is called *salœratus*. When purified by crystallization, it constitutes the official bicarbonate.

Official Description.—Colorless, transparent, monoclinic prisms or a white granular powder.

Odor, Taste, and Reaction.—Odorless, and having a saline and slightly alkaline taste. An aqueous solution of Potassium Bicarbonate (1 in 10) is slightly alkaline to litmus but is neutral or slightly alkaline to phenolphthalein T.S., and effervesces with acids. It is permanent in the air.

Solubility.—One Gm. of Potassium Bicarbonate dissolves in 2.8 mils of water at 25° C. (77° F.); also in 2 mils of water at 50° C. (122° F.); almost insoluble in alcohol.

Tests for Identity.—When heated above 50° C. (122° F.), an aqueous solution of the salt rapidly loses carbon dioxide and water, and, at boiling heat, the salt is entirely converted into normal carbonate.

The dry salt begins to lose carbon dioxide and water at 100° C. (212° F.), and this loss increases at a higher temperature, until at a red heat a residue of carbonate remains which imparts a violet color to a non-luminous flame.

An aqueous solution of Potassium Bicarbonate (1 in 10) yields a white, crystalline precipitate of potassium bitartrate with excess of tartaric acid T.S.

Impurities and Tests for Impurities.—*Carbonate.*—Add 2 mils of tenth-normal hydrochloric acid V.S. and 2 drops of phenolphthalein T.S. to 1 Gm. of the salt, dissolved without agitation in 20 mils of distilled water at a temperature not above 15° C. (59° F.); a red tint does not appear immediately.

Heavy Metals.—An aqueous solution of the salt (1 in 50), mixed with a slight excess of hydrochloric acid does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dissolve about 4 Gm. of Potassium Bicarbonate, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed, in 25 mils of distilled water and titrate with normal sulphuric acid V.S., methyl orange T.S. being used as indicator. It shows, in the dried salt, not less than 99 per cent. of $KHCO_3$.

Each mil of normal sulphuric acid V.S. used corresponds to 0.10011 Gm. of $KHCO_3$. Each gramme of Potassium Bicarbonate, previously dried, corresponds to not less than 9.9 mils of normal sulphuric acid V.S.

U. S. P. Preparations.—Liquor Magnesii Citratis; Liquor Potassii Arsenitis; Liquor Potassii Citratis.

N. F. Preparations.—Liquor Antisepticus Alkalinus; Liquor Arsenicalis, Clemens; Liquor Magnesii Sulphatis Effervescens; Liquor Phosphatum Compositus.

Uses.—This salt is largely used as affording the purest available source of the potassium salts. The large quantity of carbonic acid which it yields on decomposition renders it useful in beverages and laxative draughts, such as solution of magnesium citrate. It is milder than the carbonate, and when administered internally it is more acceptable to the stomach. The dose is from fifteen to thirty grains (1 to 2 Gm.).

POTASSII BITARTRAS. U. S. Potassium Bitartrate

[**Pot. Bitart.**—Cream of Tartar]

It contains, when dried to constant weight at 100° C (212° F.)., not less than 99.5 per cent. of $KHC_4H_4O_6$ (188.14). Preserve it in well-closed containers.

Preparation.—This well known salt is made by purifying *argol,* or *tartar,* a substance deposited in wine casks during the fermentation of the grape juice. (See Acid Saccharine Fruits, Part IV.)

Official Description.—Colorless or slightly opaque, rhombic crystals, or a white, somewhat gritty powder.

Odor, Taste, and Reaction.—Odorless, and having a pleasant, acidulous taste. A saturated aqueous solution of the salt is acid to litmus. It is permanent in the air.

Solubility.—One Gm. of Potassium Bitartrate dissolves in 155 mils of water and in 8820 mils of alcohol at 25° C. (77° F.); also in 16 mils of boiling water.

Tests for Identity.—When the salt is heated it chars and emits inflammable vapors having the odor of burning sugar. At a higher temperature, with free access of air, the carbon of the black residue is consumed, and a white, fused mass of potassium carbonate remains, which has an alkaline reaction and effervesces strongly with acids.

With sodium cobaltic nitrite T.S. a saturated aqueous solution of the salt yields a yellow precipitate.

Neutralize a saturated aqueous solution of the salt with potassium hydroxide T.S., add silver nitrate T.S., then just sufficient ammonia water to dissolve the white precipitate and boil the solution; silver is deposited on the sides of the test tube, forming a mirror.

Impurities and Tests for Impurities.—*Starch, kaolin, calcium phosphate, or other insoluble matter.*—When 0.5 Gm. of the salt is dissolved in 3 mils of ammonia water, no insoluble residue remains.

Heavy Metals.—Ten mils of an aqueous solution of the salt (1 in 50), made with the aid of just sufficient hydrochloric acid, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Ammonia is not evolved on heating the salt with a slight excess of potassium hydroxide T.S.

Alum.—Mix 1 Gm. of Potassium Bitartrate, in a platinum crucible, with 0.5 mil of sulphuric acid and 1 mil of nitric acid, and heat the mixture until fumes of sulphur trioxide begin to be liberated. Cool the resulting mass and treat it with 10 mils of distilled water and filter. The filtrate, upon being made slightly alkaline with potassium hydroxide T.S., does not yield a gelatinous precipitate soluble in excess of the reagent.

Heat 10 Gm. of Potassium Bitartrate with 15 mils of distilled water and add hydrochloric acid until the salt is dissolved, then add 2 mils of sulphurous acid and boil the mixture until the odor of sulphur dioxide is barely perceptible. Cool the solution, mix it with 1 mil of sodium cyanide T.S., and follow this immediately with stronger ammonia water until the precipitate first formed is redissolved and the solution has a slight odor of ammonia. When it is cold, transfer the solution to a glass-stoppered cylinder graduated to 50 mils, dilute it with sufficient distilled water to measure 50 mils, and add 3 drops of sodium sulphide T.S. After mixing well, the color produced in the solution, if any, when viewed downward against a white surface, is not greater than the color of a control solution prepared as follows: Dissolve 2 Gm. of ammonium chloride (see U. S. P. Reagents, Chapter LXII) in 20 mils of distilled water, add 4 mils of a solution containing 0.08 Gm. of lead nitrate in 1000 mils of distilled water, and then 1 mil of diluted hydrochloric acid. Treat this solution with the same quantity of hydrochloric acid, sulphurous acid, sodium cyanide T.S., and stronger ammonia water, as used above, transfer it to another 50 mil glass-stoppered cylinder, and then dilute it with sufficient distilled water to make 50 mils and add 3 drops of sodium sulphide T.S. (before adding the sodium sulphide T.S., the liquid must possess a distinct odor of ammonia and the two cylinders used must be matched, be of practically colorless glass and have the same internal diameter).

Assay.—Dissolve about 6 Gm. of Potassium Bitartrate, previously dried to constant weight at 100° C. (212° F.) and accurately weighed, in 100 mils of boiling distilled water and titrate with normal potassium hydroxide V.S., using phenolphthalein T.S. as indicator. It shows, in the dried salt, not less than 99.5 per cent. of $KHC_4H_4O_6$.

Each mil of normal potassium hydroxide V.S. used corresponds to 0.18814 Gm. of $KHC_4H_4O_6$. Each gramme of Potassium Bitartrate, previously dried, corresponds to not less than 5.29 mils of normal potassium hydroxide V.S.

The presence of lead, which may be introduced during the manufacturing process, through the use of sulphuric acid containing lead, is limited by the official tests to 20 parts in one million. This is the limit fixed by the U. S. Government for lead in food products and potassium bitartrate is classified as a food through its large use in "baking powders."

U. S. P. Preparation.—Pulvis Jalapæ Compositus.

N. F. Preparations.—Liquor Cocci; Species Laxativæ; Trochisci Sulphuris et Potassii Bitartratis.

Uses.—This salt is the source of tartaric acid and some of the tartrates. It is one of the ingredients in compound powder of jalap, and is frequently used as a refrigerant and purgative in doses of thirty grains to four drachms (2 to 16 Gm.)

POTASSII BROMIDUM. U. S. Potassium Bromide

[Pot. Brom.]

It contains, when dried to constant weight at 100° C. (212° F.), not less than 98.5 per cent. of KBr (119.02). Preserve it in well-closed containers.

Preparation.—Two methods are used in making this salt. In the one which was formerly official, ferrous bromide, made by acting on iron with bromine, is treated with potassium carbonate; ferrous carbonate is precipitated, and potassium bromide remains in solution. The latter is filtered and evaporated, that crystals may form.

$$\underset{\text{Ferrous Bromide}}{FeBr_2} + \underset{\text{Potassium Carbonate}}{K_2CO_3} = \underset{\text{Ferrous Carbonate}}{FeCO_3} + \underset{\text{Potassium Bromide}}{2KBr}$$

In the other method, bromine is added to solution of potassium hydroxide, producing potassium bromide and bromate. The solution is evaporated to dryness, mixed with charcoal, and heated to redness. The bromate is deoxidized and converted into bromide, carbon monoxide escaping.

$$\underset{\text{Potassium Bromate}}{2KBrO_3} + \underset{\text{Carbon}}{3C_2} = \underset{\text{Potassium Bromide}}{2KBr} + \underset{\text{Carbon Monoxide}}{6CO}$$

The presence of chlorides in potassium bromide often to the extent of 3 per cent. is due to the difficulty of obtaining the bromine, which is used in making it, free from chlorine.

Formerly this salt was imported. It is now made in the United States upon a large scale, and is exported.

Official Description.—As colorless, or white, cubical crystals, or as a granular powder.

Odor, Taste, and Reaction.—Odorless, and having a strongly saline taste; permanent in the air. Its aqueous solution (1 in 20) is neutral or faintly alkaline to litmus.

Solubility.—One Gm. dissolves in 1.5 mils of water, about 250 mils of alcohol, and in 4.6 mils of glycerin at 25° C. (77° F.); also in 1 mil of boiling water and in about 21 mils of boiling alcohol.

Tests for Identity.—When heated on platinum foil it decrepitates; upon further heating it fuses without decomposition and at a bright red heat volatilizes, communicating a violet color to a non-luminous flame.

The addition of 5 mils of sodium bitartrate T.S. to 5 mils of an aqueous solution of the salt (1 in 5) produces a white crystalline precipitate.

Silver nitrate T.S. added to an aqueous solution of the salt (1 in 10) produces a yellowish-white precipitate, insoluble in nitric acid or in a moderate excess of ammonia water.

Impurities and Tests for Impurities.—*Alkali.*—Dissolve 1 Gm. of Potassium Bromide in 10 mils of distilled water and add 0.1 mil of tenth-normal sulphuric acid V.S.; no color is produced by the subsequent addition of a drop of phenolphthalein T.S., even after heating.

Iodide.—Add a few drops of ferric chloride T.S. to 10 mils of an aqueous solution of the salt (1 in 20), shake the mixture, and add 1 mil of chloroform; the latter does not acquire a violet tint.

Bromate.—Drop 1 mil of diluted sulphuric acid upon about 1 Gm. of the powdered salt; no yellow color appears at once.

Barium Sulphate.—Separate portions of 10 mils each of an aqueous solution of the salt (1 in 20), when acidulated with hydrochloric acid, are not immediately rendered turbid by the addition of 1 mil of potassium sulphate T.S.; nor by 1 mil of barium chloride T.S.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dry the salt to constant weight at 100° C. (212° F.) and proceed as directed under the Assay for bromides (see U. S. P., Test No. 5, Chapter LXII). It shows, in the dried salt, not less than 98.5 per cent. of KBr.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.011902 Gm. of KBr. Each gramme of Potassium Bromide, previously dried, corresponds to not less than 82.8 mils nor more than 84.8 mils of tenth-normal silver nitrate V.S.

N. F. Preparations.—Elixir Potassii Bromidi; Elixir Trium Bromidorum; Liquor Bromi; Mistura Chlorali et Potassii Bromidi Composita; Sal Potassii Bromidi Effervescens; Sal Potassii Bromidi Effervescens Compositus; Syrupus Bromidorum.

Uses.—Potassium bromide is largely used as a nervine, in doses of fifteen grains (1 Gm.), frequently repeated.

POTASSII CARBONAS. U. S. Potassium Carbonate
[Pot. Carb.—Salt of Tartar]

It contains, when dried to constant weight at 180° C. (356° F.) not less than 99 per cent. of K_2CO_3 (138.20). It contains not more than 15 per cent. of moisture. Preserve it in air-tight containers.

Preparation.—This salt, known commercially as *Salt of Tartar* or *Sal Tartar*, is made by dissolving pearlash, or impure potassium carbonate, in an equal weight of cold water, allowing the mixture to stand a day or two, filtering the solution, pouring it into a bright iron dish, and evaporating over a gentle fire until it thickens, then removing it from the fire and stirring constantly with an iron spatula, so as to form a granular salt (see page 265).

A purer carbonate is produced by decomposing potassium bicarbonate by heating to redness, thus driving off water of crystallization and a portion of the carbon dioxide.

$$\underset{\substack{\text{Potassium}\\\text{Bicarbonate}}}{2KHCO_3} = \underset{\substack{\text{Potassium}\\\text{Carbonate}}}{K_2CO_3} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{CO_2} + \underset{\text{Water}}{H_2O}$$

Perhaps the largest proportion of potassium carbonate at the present time is, however, obtained from native potassium chloride and sulphate from the Stassfurt mines in Germany. A process similar to that of Leblanc for producing sodium carbonate (see page 751) is used and a very pure potassium carbonate obtained.

Official Description.—A white, granular powder.

Odor, Taste, and Reaction.—Odorless, and having a strongly alkaline taste; very deliquescent. An aqueous solution of Potassium Carbonate (1 in 20) is strongly alkaline to litmus and phenolphthalein T.S., and effervesces with acids.

Solubility.—One Gm. of Potassium Carbonate dissolves in 0.9 mil of water at 25° C.; (77° F.); also in 0.7 mil of boiling water; insoluble in alcohol.

Tests for Identity.—When heated to 180° C., (356° F.), the salt loses all the water which it may have retained or absorbed; at a bright red heat it melts, and at a white heat it volatilizes, communicating to a non-luminous flame a violet color with not more than a transient yellow tinge.

An aqueous solution of the salt (1 in 10) yields with an excess of tartaric acid T.S. a white crystalline precipitate of potassium bitartrate.

Impurities and Tests for Impurities.—*Earthy Impurities.*—No residue is left on dissolving 1 Gm. of the salt in 20 mils of distilled water.

Heavy Metals.—An aqueous solution of Potassium Carbonate (1 in 50), mixed with a slight excess of hydrochloric acid, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Moisture.—Take about 3 Gm. of Potassium Carbonate, weigh accurately, and dry to constant weight in an air bath at 180° C. (356° F.); it loses not more than 15 per cent. in weight.

Assay.—Dissolve about 3 Gm. of Potassium Carbonate, previously dried to constant weight at 180° C. (356° F.) and accurately weighed in a stoppered weighing-bottle, in 25 mils of distilled water and titrate with normal sulphuric acid V.S., methyl orange T.S. being used as indicator. It shows, in the dried salt, not less than 99 per cent. of K_2CO_3.

Each mil of normal sulphuric acid V.S. used corresponds to 0.06910 Gm. of K_2CO_3. Each gramme of Potassium Carbonate, previously dried, corresponds to not less than 14.33 mils of normal sulphuric acid V.S.

U. S. P. Preparations.—Pilulæ Ferri Carbonatis; Syrupus Rhei; Syrupus Rhei Aromaticus.

N. F. Preparations.—Elixir Formatum; Liquor Cocci; Liquor Potassæ Chlorinatæ; Mistura Carminativa; Mistura Ferri Composita; Mistura Opii et Sassafras; Mistura Rhei Alkalina; Sal Vichyanum Factitium; Sal Vichyanum Factitium Effervescens; Sal Vichyanum Factitium Effervescens cum Lithio; Syrupus Asari Compositus; Tinctura Guaiaci Composita; Tinctura Rhei Aquosa; Unguentum Sulphuris Alkalinum; Vinum Aurantii Compositum.

Uses.—Potassium carbonate is an antacid, but it is less agreeable than the bicarbonate. The dose is fifteen grains (1 Gm.), largely diluted. In large doses it is an irritant caustic, the proper antidotes to administer being diluted vinegar, lemon juice, or weak acids.

POTASSII CHLORAS. U. S. Potassium Chlorate

[Pot. Chloras]

It contains not less than 99 per cent. of $KClO_3$ (122.56). Preserve it in well-closed containers. *Great caution should be observed in handling it*, as dangerous explosions are liable to occur when it is heated or subjected to concussion or trituration with organic substances (cork, tannic acid, dust, sugar, etc.), or with sulphur, sulphides, hypophosphites, or other easily oxidizable substances.

Preparation.—Chlorate of Potash, as it is always termed commercially, was formerly made by passing chlorine gas into a solution of potassium hydroxide. This is a very wasteful process, as only one-fifth of the potassium hydroxide is obtained as chlorate, the rest passing into potassium chloride. It is now more economically prepared by boiling together solutions of potassium chloride and calcium hypochlorite, whereby potassium chlorate and calcium chloride are produced.

When a solution of calcium hypochlorite is boiled, it is decomposed, and calcium chlorate and calcium chloride are formed:

$$\underset{\substack{\text{Calcium}\\ \text{Hypochlorite}}}{3Ca(ClO)_2} = \underset{\substack{\text{Calcium}\\ \text{Chloride}}}{2CaCl_2} + \underset{\substack{\text{Calcium}\\ \text{Chlorate}}}{Ca(ClO_3)_2}$$

When solution of calcium chlorate is heated in contact with potassium chloride, double decomposition takes place as shown by the following equation:

$$\underset{\substack{\text{Calcium}\\ \text{Chlorate}}}{Ca(ClO_3)_2} + \underset{\substack{\text{Potassium}\\ \text{Chloride}}}{2KCl} = \underset{\substack{\text{Potassium}\\ \text{Chlorate}}}{2KClO_3} + \underset{\substack{\text{Calcium}\\ \text{Chloride}}}{CaCl_2}$$

The potassium chlorate is easily separated from the calcium chloride, because it is much less soluble than the latter.

This salt is now made by electrolysis by placing opposite to each other in a solution of potassium chloride, anodes and cathodes, without being separated by a porous diaphragm. The electric current causes the formation of potassium hypochlorite in the solution, which by boiling is converted into potassium chlorate and potassium chloride.

Official Description.—In colorless, lustrous, monoclinic prisms or plates, or as a white granular powder.

Odor, Taste, and Reaction.—Odorless, and having a saline taste; permanent in the air. An aqueous solution of the salt (1 in 20) is neutral to litmus.

Solubility.—One Gm. of Potassium Chlorate dissolves in 11.5 mils of water at 25° C. (77° F.); also in 1.8 mils of boiling water; almost insoluble in alcohol; soluble in glycerin.

Tests for Identity.—When heated the salt melts, gives off oxygen, and finally leaves a residue of potassium chloride, readily soluble in water and yielding with silver nitrate T.S. a white precipitate, insoluble in nitric acid but readily soluble in ammonia water. To a non-luminous flame it imparts a violet color.

With an excess of tartaric acid T.S. a solution of the salt (1 in 20) slowly yields a scant, white, crystalline precipitate; with platinic chloride T.S., a similar solution yields a yellow crystalline precipitate.

Add about 0.2 Gm. of the salt to 1 mil of hydrochloric acid; the liquid assumes a deep greenish-yellow color, and chlorine and oxides of chlorine are evolved.

Impurities and Tests for Impurities.—*Heavy Metals.*—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Transfer to a 250 mil flask about 0.1 Gm. of Potassium Chlorate, accurately weighed, and dissolve it in 10 mils of distilled water, then add 25 mils of acidulated ferrous sulphate T.S. to the solution. Prepare a valve stopper by taking a piece of rubber tubing of convenient diameter and about 5 cm. in length, placing a piece of glass rod in one end and slipping the other end over a glass tube which passes through a perforated stopper of a size convenient to fit the flask used. Cut a longitudinal slit about 15 mm. long in one side of the rubber tube about half way up. Insert this stopper in the flask and boil the mixture for ten minutes. Now cool the mixture, add 10 mils of manganous sulphate T.S. and titrate the excess of ferrous sulphate with tenth-normal potassium permanganate V.S. At the same time conduct a parallel experiment with another portion of 25 mils of acidulated ferrous sulphate T.S. and subtract the result of the latter titration from that of the former. It shows not less than 99 per cent. of $KClO_3$.

Each mil of tenth-normal potassium permanganate V.S. used corresponds to 0.0020427 Gm. of $KClO_3$. Each gramme of Potassium Chlorate corresponds to not less than 484.7 mils of tenth-normal potassium permanganate V.S.

U. S. P. Preparation.—Trochisci Potassii Chloratis.

N. F. Preparations.—Gargarisma Guaiaci Compositum; used in making Liquor Chlori Compositus.

Uses.—Potassium chlorate is used chemically as a source for obtaining oxygen, and medicinally is largely employed in diphtheria, sore throat, scarlet fever, etc., in doses of from four to twenty grains (0.25 to 1.3 Gm.)

POTASSII CITRAS. U. S. Potassium Citrate
[Pot. Cit.]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99 per cent. of $K_3C_6H_5O_7+H_2O$ (324.36). Preserve it in well-closed containers.

Preparation.—This salt is made by adding potassium bicarbonate to a solution of citric acid until effervescence ceases, filtering the solution, evaporating to dryness, and granulating (see page 265).

$$\underset{\text{Potassium Bicarbonate}}{3KHCO_3} + \underset{\text{Citric Acid}}{H_3C_6H_5O_7} = \underset{\text{Potassium Citrate}}{K_3C_6H_5O_7} + \underset{\text{Water}}{3H_2O} + \underset{\text{Carbon Dioxide}}{3CO_2}$$

Manufacturers generally use the carbonate as the source of the potassium, as it is much cheaper than the bicarbonate. When carelessly made from the carbonate, silica may be present, which is to be suspected if the potassium citrate is not entirely soluble in water.

Official Description.—Transparent, prismatic crystals, or as a white, granular powder.

Odor, Taste, and Reaction.—Odorless, and having a cooling, saline taste; deliquescent when exposed to moist air. An aqueous solution of the salt (1 in 20) is alkaline to litmus but is not reddened by one drop of phenolphthalein T.S.

Solubility.—One Gm. of Potassium Citrate dissolves in 0.6 mil of water at 25° C. (77° F.); almost insoluble in alcohol; freely soluble in glycerin.

Tests for Identity.—When heated above 100° C. (212° F.) the salt begins to lose water and at about 200° C. (392° F.) the water of crystallization is completely lost. At a higher temperature the salt begins to decompose, turns brown, and upon further heating carbonizes and emits inflammable gases which have a very pungent, acrid odor. At a red heat a residue remains, which has an alkaline reaction and strongly effervesces with acids.

An aqueous solution of Potassium Citrate (1 in 10) yields a white, crystalline precipitate with sodium bitartrate T.S.

Mix 10 mils of an aqueous solution of the salt (1 in 20) with 10 mils of calcium chloride T.S.; the liquid remains clear until it is boiled, when a white, granular precipitate is produced.

Impurities and Tests for Impurities.—*Tartrate.*—A solution of 1 Gm. of Potassium Citrate in 1 mil of distilled water does not deposit any precipitate on the addition of 1 mil of acetic acid.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of the salt meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Dry the salt to constant weight in a desiccator over sulphuric acid, and proceed as directed under the Assay for alkali salts of organic acids (see U. S. P., Test No. 6, Chapter LXII). It shows, in the dried salt, not less than 99 per cent. of $K_3C_6H_5O_7 + H_2O$.

Each mil of half-normal sulphuric acid V.S. used corresponds to 0.05406 Gm. of $K_3C_6H_5O_7 + H_2O$. Each gramme of Potassium Citrate, previously dried, corresponds to 18.3 mils of half-normal sulphuric acid V.S.

U. S. P. Preparation.—Potassii Citras Effervescens.

N. F. Preparations.—It is used, chiefly as an aid to solution, in the following: Elixir Cinchonæ Alkaloidorum, Ferri et Calcii Lactophosphatis; Elixir Ferri Hypophosphitis; Elixir Ferri Lactatis; Elixir Hypophosphitum et Ferri; Liquor Ferri Hypophosphitis; Liquor Hypophosphitum Compositus; Syrupus Calcii Lactophosphatis et Ferri; Syrupus Ferri Hypophosphitis.

Uses.—Potassium citrate is principally employed in medicine as a diaphoretic, in doses of fifteen grains (1 Gm.). It is found in the official solution of potassium citrate.

POTASSII CITRAS EFFERVESCENS. U. S. Effervescent Potassium Citrate

[Pot. Cit. Eff.]

	Metric	Old form
***Potassium Citrate**	200 Gm.	4 oz. av.
Sodium Bicarbonate, dried and powdered	477 Gm.	9½ oz. av.
Tartaric Acid, dried and powdered	252 Gm.	5 oz. av.
Citric Acid, uneffloresced crystals	162 Gm.	3¼ oz. av.
To make about	1000 Gm.	20 oz. av.

Dry the potassium citrate on a water bath until it ceases to lose weight; after powdering the dried salt, mix it intimately with the powdered citric acid and tartaric acid, then thoroughly incorporate the sodium bicarbonate. Place the mixed powders on a plate of glass or in a suitable dish, in an oven heated between 93° and 104° C. (199.4° and 219.2° F.) Manipulate the mixture carefully with a wooden spatula, and, when it has become moist, rub it through a No. 6 tinned-iron sieve, and dry the granules at a temperature not exceeding 54° C. (129.2° F.). Immediately transfer the salt to suitable containers and seal them tightly. Care must be taken to prevent the salt from coming in contact with air containing moisture.

Uses.—This forms an agreeable diaphoretic given in cold water in doses of thirty to sixty grains (2 to 4 Gm.).

LIQUOR POTASSII CITRATIS. U. S. Solution of Potassium Citrate

[Liq. Pot. Cit.]

An aqueous solution containing not less than 8 per cent. of $K_3C_6H_5O_7$ (306.34), with small amounts of citric and carbonic acids.

	Metric	Old form
***Potassium Bicarbonate**	8 Gm.	292 grains
Citric Acid	6 Gm.	219 grains
Distilled Water, a sufficient quantity,		
To make	100 mils	8 fl. oz.

Dissolve the potassium bicarbonate and the citric acid, each, in 40 mils [old form 3 fl. oz.] of distilled water. Filter the solutions separately and wash the filters with enough distilled water to obtain in each case 50 mils [old form 4 fl. oz.]. Mix the two solutions, and, when effervescence has ceased, transfer to a bottle and stopper tightly. This preparation must not be dispensed unless it has been recently prepared

Official Description.—A clear, colorless liquid.

Odor, Taste, and Reaction.—Odorless, having a mildly saline taste, slightly acid to litmus.

Impurities and Tests for Impurities.—It conforms to the reactions and tests for an aqueous solution of the salt as given under *Potassii Citras,* when concentrated to the proper strength.

Assay.—Evaporate to dryness about 15 mils of Solution of Potassium Citrate, accurately weighed, and proceed as directed under the Assay for alkali salts of organic acids (see U. S. P. Test No. 6, Chapter LXII). It shows not less than 8 per cent. of $K_3C_6H_5O_7$. Each mil of half-normal sulphuric acid V.S. used corresponds to 0.051057 Gm. of $K_3C_6H_5O_7$. Each gramme of Solution of Potassium Citrate, after evaporation and ignition, corresponds to not less than 1.57 mils of half-normal sulphuric acid V.S.

For this preparation it will be found convenient in dispensing practice to keep the separate solutions of citric acid and potassium bicarbonate on hand ready to be mixed when the solution of potassium citrate is needed. The solutions keep moderately well. The solution contains about 8 per cent. of potassium citrate, with some free citric acid and carbonic acid gas. It responds to the reactions and tests of potassium citrate (see Potassii Citras).

This preparation is sometimes called *Neutral Mixture,* but in some localities Neutral Mixture is always understood to mean a more agreeable preparation than this solution which is made by nearly saturating lemon juice with Potassium Bicarbonate. It was official in the U. S. P. 1880 under the name of *Mistura Potassii Citratis* (see page 714).

Uses.—Solution of potassium citrate is refrigerant and diaphoretic, in doses of four fluidrachms (15 mils).

POTASSII ET SODII TARTRAS. U. S. Potassium and Sodium Tartrate

[Pot. et Sod. Tart.—Rochelle Salt]

It contains not less than 73.72 per cent. nor more than 77.39 per cent. of anhydrous potassium and sodium tartrate, corresponding to not less than 99 per cent. of the crystallized salt [$KNaC_4H_4O_6+4H_2O=282.20$]. Preserve it in well-closed containers.

Preparation.—This salt is made by adding potassium bitartrate to a solution of sodium carbonate; the proportions are shown by a former official process, which is as follows:

Take of sodium carbonate, 12 *troyounces;* potassium bitartrate, in fine powder, 16 *troyounces;* boiling water, 5 *pints.* Dissolve the sodium carbonate in the water, and gradually add the potassium bitartrate. Filter the solution, and evaporate until a pellicle begins to form; then set it aside to crystallize. Pour off the mother water, and dry the crystals on bibulous paper. Lastly, evaporate the mother water, that it may furnish more crystals.

It is advantageous to filter the solution after one-half of its volume has been evaporated and it has cooled and settled, in order to free it from the calcium tartrate which separates, otherwise the crystals will be contaminated.

The following equation shows the reaction:

$$\underset{\substack{\text{Potassium}\\ \text{Bitartrate}}}{2KHC_4H_4O_6} + \underset{\substack{\text{Sodium}\\ \text{Carbonate}}}{Na_2CO_3} = \underset{\substack{\text{Potassium and}\\ \text{Sodium Tartrate}}}{2KNaC_4H_4O_6} + \underset{\text{Water}}{H_2O} + \underset{\substack{\text{Carbon}\\ \text{Dioxide}}}{CO_2}$$

The chemical constitution of the tartrates will be fully explained under Acidum Tartaricum, but note that tartaric acid is a dibasic acid and in its acid salts the remaining hydrogen may be replaced by a base, which in this case is sodium.

Official Description.—Colorless, transparent, rhombic prisms, or a white powder.

Odor, Taste, and Reaction.—Odorless, having a cooling, saline taste. The crystals slightly effloresce in dry air. An aqueous solution of the salt (1 in 20) is alkaline to litmus, but is not reddened by a drop of phenolphthalein T.S.

Solubility—One Gm. of Potassium and Sodium Tartrate dissolves in 0.9 mil of water at 25° C. (77° F.); almost insoluble in alcohol.

Tests for Identity.—When heated to about 74° C. (165.2° F.), the salt fuses to a colorless liquid, which at a higher temperature froths, becomes brown, and gradually carbonizes, while inflammable vapors are emitted, having the odor of burning sugar. Finally, a black residue is left, consisting of potassium and sodium carbonates with carbon. To a non-luminous flame this residue imparts an intensely yellow color.

An aqueous solution of the salt (1 in 10) yields a white, crystalline precipitate with an equal volume of acetic acid.

An aqueous solution of the salt (1 in 10) yields with silver nitrate T.S. a white precipitate which becomes black on boiling.

Impurities and Tests for Impurities.—*Heavy Metals.*—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Ammonia.—Five mils of an aqueous solution of the salt (1 in 10), when heated with potassium hydroxide T.S., does not evolve *ammonia.*

Lead.—Dissolve 10 Gm. of Potassium and Sodium Tartrate in 20 mils of distilled water, add 2 mils of sulphurous acid and boil the mixture until the odor of sulphur dioxide is barely perceptible. Cool the solution, mix it with 1 mil of sodium cyanide T.S. and follow this immediately with stronger ammonia water until the precipitate formed is redissolved and the solution has a slight odor of ammonia. When cold, transfer the solution to a glass-stoppered cylinder, graduated to 50 mils, dilute it with sufficient distilled water to measure 50 mils and add 3 drops of sodium sulphide T.S. After mixing well, the color produced in the solution, if any, when viewed downward against a white surface, is not greater than the color of a control solution prepared as follows: Dissolve 2 Gm. of ammonium chloride (see Reagents, Chapter LXII) in 20 mils of distilled water, add 4 mils of a solution containing 0.08 Gm. of lead nitrate in 1000 mils of distilled water, and then 1 mil of diluted hydrochloric acid. Treat this solution with the same quantity of sulphurous acid, sodium cyanide T.S. and stronger ammonia water, as used above, transfer it to another 50-mil glass-stoppered cylinder, and then dilute it with sufficient distilled water to make 50 mils and add 3 drops of sodium sulphide T.S. (before adding the sodium sulphide T.S., the liquid must possess a distinct odor of ammonia, and the two cylinders used must be matched, be of practically colorless glass, and have the same internal diameter).

Assay.—Proceed as directed under the Assay for alkali salts of organic acids (see U. S. P., Test No. 6, Chapter LXII). It shows not less than 73.72 per cent. nor more than 77.39 per cent. of $KNaC_4H_4O_6$.

Each mil of half-normal sulphuric acid V.S. used corresponds to 0.05253 Gm. of $KNaC_4H_4O_6$. Each gramme of Potassium and Sodium Tartrate corresponds to not less than 14.03 mils nor more than 14.73 mils of half-normal sulphuric acid V.S.

U. S. P. Preparation.—Pulvis Effervescens Compositus.

Uses.—Rochelle salt, as it is habitually termed, is an efficient purgative in the dose of one-quarter ounce to an ounce (8 to 31 Gm.). It is an important ingredient in the well-known Seidlitz powders.

POTASSII HYPOPHOSPHIS. U. S. Potassium Hypophosphite
[Pot. Hypophos.]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 98 per cent. of KPH_2O_2 (104.16). Preserve it in well-closed containers in a dry place. Caution should be observed in dispensing Potassium Hypophosphite, as an explosion is liable to occur when it is triturated or heated with nitrates, chlorates, or other oxidizing agents.

Preparation.—When solutions of calcium hypophosphite and potassium carbonate are mixed, potassium hypophosphite and calcium carbonate are produced by double decomposition, thus:

$$\underset{\substack{\text{Calcium}\\\text{Hypophosphite}}}{Ca(H_2PO_2)_2} + \underset{\substack{\text{Potassium}\\\text{Carbonate}}}{K_2CO_3} = \underset{\substack{\text{Potassium}\\\text{Hypophosphite}}}{2KH_2PO_2} + \underset{\substack{\text{Calcium}\\\text{Carbonate}}}{CaCO_3}$$

The calcium carbonate is removed by filtration, and the clear solution is evaporated until a pellicle forms, after which it is constantly stirred, with continuance of the heat, until the salt granulates. The heat employed in the evaporation should be kept considerably below 100° C. (212° F.), for fear of explosion. If the salt is required to be pure, it should be dissolved in the granulated state, in official alcohol, and the solution evaporated and then set aside to crystallize.

Official Description.—White, opaque, hexagonal plates, or crystalline masses, or a granular powder.

Odor, Taste and Reaction.—Odorless; having a pungent, saline taste; very deliquescent. An aqueous solution of the salt (1 in 20) is neutral or slightly alkaline to litmus.

Solubility.—One Gm. of Potassium Hypophosphite dissolves in 0.6 mil of water and in 9 mils of alcohol at 25° C. (77° F.); also in 0.4 mil of boiling water and in 5 mils of boiling alcohol.

Tests for Identity.—An aqueous solution of the salt (1 in 20) yields with sodium bitartrate T.S. a white, crystalline precipitate. When heated in a dry test tube spontaneously inflammable hydrogen phosphide is evolved which burns with a bright yellow flame.

When an aqueous solution of the salt (1 in 20), acidulated with hydrochloric acid, is added drop by drop with agitation to an excess of mercuric chloride T.S., a white precipitate of mercurous chloride is formed. Upon the further addition of the solution of Potassium Hypophosphite, the precipitate becomes gray from reduction to metallic mercury.

Impurities and Tests for Impurities.—A solution of 1 Gm. of the salt in about 10 mils of distilled water requires not more than 1.5 mils of tenth-normal hydrochloric acid V.S. for neutralization, methyl orange T.S. being used as indicator.

Heat 5 mils of an aqueous solution of the salt (1 in 5) with 0.5 mil of diluted hydrochloric acid in a test tube on a water bath for thirty minutes; no offensive odor is developed.

Arsenic.—Measure 5 mils of an aqueous solution of Potassium Hypophosphite (1 in 25) into a beaker containing 3 mils of nitric acid diluted with about 10 mils of distilled water, and evaporate the mixture to dryness on a water bath; the residue meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Phosphates.—Add magnesia mixture T.S. to 10 mils of an aqueous solution of the salt (1 in 20) made alkaline with ammonia water; it is not affected within one minute.

Assay.—Dissolve about 1 Gm. of Potassium Hypophosphite, dried to constant weight in a desiccator over sulphuric acid and accurately weighed, in 10 mils of distilled water, add 10 mils of nitric acid and evaporate it to dryness on a water bath. Then add 5 mils of nitric acid and again evaporate it to dryness on a water bath. Dissolve the residue in 20 mils of distilled water, add a drop of phenolphthalein T.S. and sufficient special potassium hydroxide T.S. (see Reagents, Chapter LXII) to produce a pink color, and then dilute it to exactly 100 mils with distilled water. Transfer 10 mils of this solution to a 100-mil graduated flask, add 50 mils of tenth-normal silver nitrate V.S. and proceed from this point as directed in the assay under *Sodii Phosphas* (see page 764). When calculated to the amount originally taken, it shows, in the dried salt, not less than 98 per cent. of KPH_2O_2.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.003472 Gm. of KPH_2O_2. Each gramme of Potassium Hypophosphite, previously dried, corresponds to not less than 282.3 mils of tenth-normal silver nitrate V.S.

U. S. P. Preparations.—Acidum Hydriodicum Dilutum; Syrupus Hypophosphitum.

N. F. Preparations.—Elixir Hypophosphitum; Elixir Hypophosphitum et Ferri, Emulsum Olei Morrhuæ cum Hypophosphitibus; Liquor Hypophosphitum; Liquor Hypophosphitum Compositus; Syrupus Hypophosphitum Compositus.

Uses.—The official use made of potassium hypophosphite is to form one of the ingredients in the various syrups, elixirs, and solutions named above and in the production of hypophosphorous acid as a preservative in making diluted hydriodic acid. It may be given internally in the dose of eight grains (0.5 Gm.).

POTASSII IODIDUM. U. S. Potassium Iodide

[Pot. Iod.]

It contains, when dried to constant weight at 100° C. (212° F.), not less than 99 per cent. of KI (166.02). Preserve it in well-closed containers.

Preparation.—An aqueous solution of potassium hydroxide is treated with iodine in slight excess. The result is the formation of two salts, potassium iodide and iodate.

$$\underset{\substack{\text{Potassium}\\\text{Hydroxide}}}{6KOH} + \underset{\text{Iodine}}{(I_2)_3} = \underset{\substack{\text{Potassium}\\\text{Iodide}}}{5KI} + \underset{\substack{\text{Potassium}\\\text{Iodate}}}{KIO_3} + \underset{\text{Water}}{3H_2O}$$

By evaporating the solution to dryness, the mixed salts are obtained; and if the dry mass be exposed to a red heat, the iodate will be converted into potassium iodide, thus removing this impurity.

The mixed salts, toward the close of their evaporation to dryness, should be mixed with powdered charcoal, which facilitates the deoxidation of the iodate. This is accomplished at a dull red heat, the potassium iodide being dissolved out of the mass, and the solution set aside to crystallize.

$$\underset{\substack{\text{Potassium}\\\text{Iodate}}}{KIO_3} + \underset{\text{Carbon}}{3C} = \underset{\substack{\text{Potassium}\\\text{Iodide}}}{KI} + \underset{\substack{\text{Carbon}\\\text{Monoxide}}}{3CO}$$

It may also be reduced with hydrogen dioxide as follows:

$$\underset{\substack{\text{Potassium}\\\text{Iodate}}}{KIO_3} + \underset{\substack{\text{Hydrogen}\\\text{Dioxide}}}{3H_2O_2} = \underset{\substack{\text{Potassium}\\\text{Iodide}}}{KI} + \underset{\text{Water}}{3H_2O} + \underset{\text{Oxygen}}{3O_2}$$

It is also prepared by forming ferric iodide, through the reaction between iron wire and iodine, adding a solution of pure potassium carbonate until the solution is faintly alkaline, boiling for a few moments, filtering, concentrating the filtrate, and setting it aside to crystallize.

The reactions are as follows:

$$\underset{\text{Iron}}{Fe} + \underset{\text{Iodine}}{I_2} = \underset{\substack{\text{Ferrous}\\\text{Iodide}}}{FeI_2}$$

The excess of iron is filtered out and sufficient iodine is added to make ferric iodide.

$$\underset{\substack{\text{Ferrous}\\\text{Iodide}}}{2FeI_2} + \underset{\text{Iodine}}{I_2} = \underset{\substack{\text{Ferric}\\\text{Iodide}}}{Fe_2I_6}$$

Then the potassium carbonate is added.

$$\underset{\substack{\text{Ferric}\\ \text{Iodide}}}{Fe_2I_6} + \underset{\substack{\text{Potassium}\\ \text{Carbonate}}}{3K_2CO_3} + \underset{\text{Water}}{3H_2O} = \underset{\substack{\text{Potassium}\\ \text{Iodide}}}{6KI} + \underset{\substack{\text{Carbon}\\ \text{Dioxide}}}{3CO_2} + \underset{\substack{\text{Ferric}\\ \text{Hydroxide}}}{Fe_2(OH)_6}$$

Potassium iodide is always crystallized from an alkaline solution if the manufacturer expects to avoid loss through the discoloration of the product from the separation of free iodine. The official test permits the presence of a small excess of alkali.

Official Description.—As cubical crystals either transparent and colorless or more or less opaque and white, or as a white, granular powder.

Odor, Taste, and Reaction.—Having a pungent, saline, afterwards bitter taste; permanent in dry air, and but slightly deliquescent in moist air. An aqueous solution of the salt (1 in 20) is neutral or slightly alkaline to litmus.

Solubility.—One Gm. of Potassium Iodide dissolves in 0.7 mil of water, 22 mils of alcohol, and in 2 mils of glycerin at 25° C. (77° F.); also in 0.5 mil of boiling water and in 8 mils of boiling alcohol.

Tests for Identity.—When heated, the salt decrepitates. At a low red heat it fuses, and at a bright red heat it is volatilized without decomposition.

Five mils of an aqueous solution of Potassium Iodide (1 in 20) yields a white, crystalline precipitate with 5 mils of sodium bitartrate T.S.

Add 1 mil of ferric chloride T.S., diluted with an equal volume of distilled water, to 5 mils of an aqueous solution of the salt (1 in 20), and shake the mixture with 5 mils of chloroform; the latter acquires a violet color.

Impurities and Tests for Impurities.—*Alkali.*—Dissolve 1 Gm. of the salt in 10 mils of distilled water and add 0.1 mil of tenth-normal sulphuric acid V.S.; no color is produced by the subsequent addition of a drop of phenolphthalein T.S.

Iodate.—Add 2 drops of diluted sulphuric acid (free from sulphurous and nitrous acids) to 0.5 Gm. of the salt dissolved in 10 mils of distilled water, which has previously been boiled and cooled; no distinct yellow color appears within half a minute, and

Thiosulphate.—No turbidity occurs.

Barium.—Acidulate 10-mil sof an aqueous solution of the salt (1 in 20) with hydrochloric acid; it is not rendered turbid by the addition of 1 mil of potassium sulphate T.S.

Sulphate.—Another 10-mil portion of an aqueous solution of the salt (1 in 20), acidulated with hydrochloric acid, is not rendered more than slightly turbid by a few drops of barium chloride T.S.

Cyanide.—Heat gently 5 mils of an aqueous solution of the salt (1 in 10) with one drop of ferrous sulphate T.S. and 0.5 mil of potassium hydroxide T.S.; no blue color appears after acidulating the mixture with hydrochloric acid.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dry the salt to constant weight and proceed as directed under the Assay for iodides (see U. S. P., Test No. 5, Chapter LXII). It shows, in the dried salt, not less than 99 per cent. of KI.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.016602 Gm. of KI. Each gramme of Potassium Iodide, previously dried, corresponds to not less than 59.6 mils nor more than 61.0 mils of tenth-normal silver nitrate V.S.

U. S. P. Preparations.—Acidum Hydriodicum Dilutum; Liquor Iodi Compositus; Tincture Iodi; Unguentum Iodi.

N. F. Preparations.—Elixir Corydalis Compositum; Elixir Sodii Salicylatis Compositum; Liquor Hydrargyri et Potassii Iodidi; Tinctura Iodi Fortior; Unguentum Potassii Iodidi.

Uses.—This is the most valuable medicinal compound of iodine, if the extent to which it is employed is a criterion. It is used as an alterative in from 5 to 8 grain doses (0.32 to 0.5 Gm.); as an antisyphilitic, four drachms (16 Gm.), largely diluted, may be given.

POTASSII NITRAS. U. S. Potassium Nitrate

[**Pot. Nit.**—SALTPETRE]

It contains, when dried to constant weight at 100° C. (212° F.), not less than 99 per cent. of KNO_3 (101.11). Preserve it in well-closed containers.

Preparation.—*Nitre,* or *Saltpetre,* is sometimes a natural product; usually, however, it is produced artificially in what are known as nitre beds, which are made up of earth and wood ashes, with animal and vegetable refuse; these are protected from rain by sheds. In time the ammonia, produced by the decomposition of the organic matter in the mixture, is oxidized, nitric acid is formed, and this unites with the potassium hydroxide in the wood ashes, and gradually forms potassium nitrate. The salt is then separated by lixiviation, filtration, evaporation, and crystallization. It is generally imported from Europe or India in a crude state and refined in this country.

Official Description.—Colorless, transparent, six-sided rhombic prisms, or a white, crystalline powder.

Odor, Taste, and Reaction.—Odorless, having a saline taste and producing a cooling sensation in the mouth. Slightly hygroscopic in moist air. Its aqueous solution (1 in 10) is neutral to litmus.

Solubility.—One Gm. of Potassium Nitrate dissolves in 2.8 mils of water and in 620 mils of alcohol at 25° C. (77° F.); also in 0.5 mil of boiling water; soluble in glycerin.

Tests for Identity.—When strongly heated, the salt melts without decomposition. At higher temperatures it evolves oxygen and is partly reduced to nitrite. When Potassium Nitrate is heated with charcoal, the mixture deflagrates.

With sodium bitartrate T.S. an aqueous solution of the salt (1 in 20) yields a white crystalline precipitate.

Mix an aqueous solution of Potassium Nitrate (1 in 10) in a test tube with a drop of diphenylamine T.S. and slowly add sulphuric acid so as to form a separate layer; a deep blue color appears at the line of contact.

Impurities and Tests for Impurities.—*Heavy Metals.*—An aqueous solution of Potassium Nitrate does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Chlorate or Perchlorate.—No yellow color appears when 0.1 Gm. of the dry salt is sprinkled upon 1 mil of concentrated sulphuric acid.

Assay.—Dissolve about 0.4 Gm. of Potassium Nitrate, previously dried to constant weight at 100° C. (212° F.), and accurately weighed, in 10 mils of hydrochloric acid in a small dish, and evaporate the solution to dryness on a water bath. Dissolve the residue in 10 mils of hydrochloric acid and again evaporate it to dryness on a water bath, continuing the heat until the residue, when redissolved in distilled water, is neutral to litmus. Transfer the residue with the aid of 25 mils of distilled water to a flask and proceed as directed under the Assay for chlorides (see U. S. P., Test No. 5, Chapter LXII), deducting from the amount of tenth-normal silver nitrate V.S. consumed the amount which would be consumed by the chlorides present in an equivalent weight of the salt originally taken, and previously estimated by taking about 1 Gm. of the salt, accurately weighed, and proceeding as directed under the Assay for chlorides (see U. S. P., Test No. 5, Chapter LXII). It shows, in the dried salt, not less than 99 per cent. of KNO_3.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.010111 Gm. of KNO_3. Each gramme of Potassium Nitrate, previously dried, corresponds to not less than 97.9 mils of tenth-normal silver nitrate V.S.

N. F. Preparation.—Charta Potassii Nitratis.

Uses.—Potassium nitrate is diuretic and diaphoretic in doses of eight to twenty grains (0.5 to 1.3 Gm.). In concentrated solution it is antiseptic. It is most largely used in making gunpowder.

POTASSII PERMANGANAS. U. S. **Potassium Permanganate**

[Pot. Permang.]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99 per cent. of $KMnO_4$ (15 3). Preserve it in glass-stoppered bottles. Potassium Permanganate when in solution or in the dry condition must not be brought into contact with organic or other readily oxidizable substances.

Preparation.—This salt is made by boiling a solution of potassium manganate with water or by passing carbon dioxide through the solution.

$$\underset{\substack{\text{Potassium}\\ \text{Manganate}}}{3K_2MnO_4} + \underset{\text{Water}}{2H_2O} = \underset{\substack{\text{Potassium}\\ \text{Permanganate}}}{K_2Mn_2O_8} + \underset{\substack{\text{Manganese}\\ \text{Dioxide}}}{MnO_2} + \underset{\substack{\text{Potassium}\\ \text{Hydroxide}}}{4KOH}$$

or

$$\underset{\substack{\text{Potassium}\\ \text{Manganate}}}{3K_2MnO_4} + \underset{\substack{\text{Carbon}\\ \text{Dioxide}}}{2CO_2} = \underset{\substack{\text{Potassium}\\ \text{Permanganate}}}{K_2Mn_2O_8} + \underset{\substack{\text{Manganese}\\ \text{Dioxide}}}{MnO_2} + \underset{\substack{\text{Potassium}\\ \text{Carbonate}}}{K_2CO_3}$$

Potassium manganate is made by heating manganese dioxide with potassium hydroxide with or without the aid of an oxidizing agent like potassium chlorate; the potassium hydroxide liberated by the reaction requires neutralization with an acid if all the permanganate is to be obtained, because the latter, in the presence of an excess of alkali, remains in the condition of manganate.

Official Description.—Slender, monoclinic prisms, of a dark purple color, almost opaque by transmitted light, and of a blue, metallic luster by reflected light.

Odor and Taste.—Odorless, and having (in solution) a taste at first sweet, but afterwards disagreeable and astringent. Permanent in the air.

Solubility.—One Gm. of Potassium Permanganate dissolves in 13.5 mils of water at 25° C. (77° F.); also in 3.5 mils of boiling water; it is decomposed by alcohol.

Tests for Identity.—When heated, the salt decrepitates, and at about 240° C. (464° F.), it decomposes, yielding oxygen, potassium manganate, and manganese dioxide.

An aqueous solution of the salt is of a deep violet-red color when concentrated, and of a rose color when highly diluted. The color is discharged by hydrogen sulphide, ferrous sulphate, oxalic acid, alcohol, and many other substances, especially if the solution is first rendered acid by sulphuric acid.

Assay.—Dissolve about 0.15 Gm. of Potassium Permanganate, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed, in 25 mils of distilled water, mix the solution with 1 mil of sulphuric acid and 50 mils of tenth-normal oxalic acid V.S. and warm the mixture to about 80° C. (176° F.). The residual titration with tenth-normal potassium permanganate V.S. shows, in the dried salt, not less than 99 per cent. of $KMnO_4$.

Each mil of tenth-normal oxalic acid V.S. used corresponds to 0.0031606 Gm. of $KMnO_4$. Each gramme of Potassium Permanganate, previously dried, corresponds to not less than 313.2 mils of tenth-normal oxalic acid V.S.

Uses.—Potassium permanganate is one of the most powerful oxidizing agents known. Chemically, it is used as a volumetric test and oxidizer, for which it is admirably adapted on account of the distinctness of its color reactions, although the difficulty of keeping the solution from partial decomposition is a serious annoyance and interferes with the accuracy of the estimation. When potassium permanganate comes in contact with organic matter it is decomposed with the liberation of oxygen; this makes it a valuable disinfectant; the reaction is as follows: $K_2Mn_2O_8 = 2MnO + K_2O + 5O$; when used externally its application by means of lint, towels, etc., should be avoided, because its energy would be spent upon these instead of upon the part of the body intended to be affected by it.

In the presence of an acid forming a soluble salt of the manganese, as hydrochloric, the reaction is as follows: $K_2Mn_2O_8 + 6HCl = 2MnCl_2 + 2KCl + 3H_2O + 5O$. The MnO, in the first of these reactions, is what is deposited as a brown stain when potassium permanganate comes into contact with the skin and the second reaction illustrates why diluted sulphuric or diluted hydrochloric acid removes the stains produced on organic tissues by permanganate, through the formation of colorless salts of the manganese. The dose is one grain (0.065 Gm.). It has been used successfully as an antidote to morphine poisoning and against snake bite by injecting a strong solution into the part which has been bitten.

POTASSA CUM CALCE. N. F. Potassa with Lime

[Pot. c. Calc.]

	Metric	Old form
Potassium Hydroxide	50 Gm.	2 oz. av.
Calcium Oxide	50 Gm.	2 oz. av.
To make	100 Gm.	4 oz. av.

Triturate the ingredients together in a warm mortar, so as to form a powder, and keep it in a well-closed container.

Uses.—When used as a cauterizing agent this mixture is made into a paste with alcohol and applied for ten or fifteen minutes to the part to be cauterized.

SAL POTASSII BROMIDI EFFERVESCENS. N. F. Effervescent Salt of Potassium Bromide

[Sal Pot. Brom. Eff.—Pulvis Potassii Bromidi Effervescens, N. F. III]

	Metric	Old form
Potassium Bromide, dried	166 Gm.	3 oz. av. 140 gr.
Sodium Bicarbonate, dried	530 Gm.	10 oz. av. 263 gr.
Tartaric Acid, dried	204 Gm.	4 oz. av. 35 gr.
Citric Acid, in uneffloresced crystals	250 Gm.	5 oz. av.
To make about	1000 Gm.	20 oz. av.

Prepare an effervescent salt as directed in the National Formulary General Process (see page 265).

Average dose.—90 grains (6 Gm.).

SAL POTASSII BROMIDI EFFERVESCENS COMPOSITUS. N. F. Compound Effervescent Salt of Potassium Bromide

[Sal Pot. Brom. Eff. Co.—Pulvis Potassii Bromidi Effervescens cum Caffeina, N. F. III Effervescent Potassium Bromide with Caffeine

	Metric	Old form
Caffeine	8 Gm.	70 grains
Potassium Bromide, in crystals	83 Gm.	1 oz. av. 289 gr.
Lithium Carbonate	42 Gm.	368 gr.
Sodium Bicarbonate, dried	587 Gm.	11 oz. av. 324 gr.
Tartaric Acid, dried	180 Gm.	3 oz. av. 263 gr.
Citric Acid, in uneffloresced crystals	250 Gm.	5 oz. av.
To make about	1000 Gm.	20 oz. av.

Prepare an effervescent salt as directed in the National Formulary General Process (see page 265).

Average dose.—90 grains (6 Gm.).

POTASSII CHLORIDUM. N. F. Potassium Chloride

[Pot. Chlorid.]

It contains, when dried to constant weight at 100° C. (212° F.), not less than 99 per cent. of KCl (74.56). Preserve it in well-closed containers.

Preparation.—This salt occurs in sea water and in many mineral springs and is also mined at Stassfurt, Germany, occurring there as *carnallite*, $KCl.MgCl_2+6H_2O$, and as *sylvite*, KCl. The carnallite, in aqueous solution, is treated with live steam, the two separate salts form and the less soluble salt, potassium chloride, crystallizes out as the solution cools. It may also be prepared by dissolving potassium carbonate in hydrochloric acid.

Official Description.—It occurs in colorless, elongated, prismatic, or cubical crystals or as a white, granular powder; permanent in dry air.

Odor, Taste, and Reaction.—Odorless; taste saline. An aqueous solution of the salt (1 in 10) is clear and neutral to litmus.

Solubility.—One gramme dissolves in 2.8 mils of water at 25° C. (77° F.), slightly more soluble in boiling water, insoluble in alcohol.

Tests for Identity.—When heated, the dry salt decrepitates. To a non-luminous flame it imparts a violet color unmasked by yellow.

An aqueous solution of the salt yields with silver nitrate T.S. a white, curdy precipitate insoluble in nitric acid but soluble in an excess of ammonia water.

Impurities and Tests for Impurities.—*Calcium or Magnesium.*—Boil 5 mils of an aqueous solution of the salt (1 in 10) in a test tube, then add an equal volume of barium hydroxide T.S. and stopper the tube; the solution is not rendered cloudy within fifteen minutes.

Iodide or Bromide.—Dissolve 2 Gm. of the salt in 6 mils of distilled water, add 1 mil of chloroform, and then add, drop by drop, with constant agitation, 5 mils of half-strength chlorine water; the chloroform does not acquire a transient violet or permanent orange color.

Arsenic.—An aqueous solution of the salt meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dissolve about 0.25 Gm. of Potassium Chloride, previously dried to constant weight at 100° C. (212° F.), and accurately weighed, in 25 mils of distilled water in a 200-mil measuring flask. Add 50 mils of tenth-normal silver nitrate V.S. to the solution, then 5 mils of nitric acid, afterward sufficient distilled water to make 200 mils and mix thoroughly. Filter the mixture through a dry filter, reject the first 20 mils of the filtrate, collect the following 100 mils of filtrate, add to this 2 mils of ferric ammonium sulphate T.S. and titrate with tenth-normal potassium sulphocyanate V.S., until the supernatant liquid remains reddish after it is well shaken. It shows, in the dried salt, not less than 99 per cent. of Potassium Chloride.

Each mil of tenth-normal silver nitrate V.S. corresponds to 0.007456 Gm. of KCl. Each gramme of Potassium Chloride, dried to constant weight, corresponds to not less than 132.8 mils of tenth-normal silver nitrate V.S.

N. F. Preparations.—Liquor Hydrastinæ Compositus; Sal Kissingense Factitium; Sal Kissingense Factitium Effervescens.

Uses.—It has long been used in medicine under the names *sal febrifugum* and *sal digestivum*. It is chiefly used to-day in the preparation of other potassium salts and in the impure form as a fertilizer.

POTASSII SULPHAS. N. F. Potassium Sulphate

(U. S. P. VIII)

[Pot. Sulph.]

It contains, when dried to constant weight at 100° C. (212° F.), not less than 99 per cent. of K_2SO_4 (174.27).

Preparation.—This salt occurs in many mineral springs, is a by-product in many chemical processes, but its chief source is *Kainite*, the double sulphate of potassium and magnesium with magnesium chloride, $K_2SO_4.\ MgSO_4.\ MgCl_2+5H_2O$, and *schoenite*, the double sulphate of potassium and magnesium, $K_2SO_4.\ 2MgSO_4+6H_2O$, both of which are mined in the Stassfurt salt bed.

In its preparation from Kainite, the ore is exposed to the air until the magnesium chloride deliquesces and runs off, the remainder is dissolved in boiling water and the less soluble potassium sulphate crystallizes first.

Official Description.—Hard, colorless, translucent, six-sided, rhombic prisms terminated by pyramids, or a white powder; permanent in the air.

Odor, Taste and Reaction.—Odorless; taste saline, somewhat bitter. An aqueous solution of the salt (1 in 20) is neutral to litmus.

Solubility.—One gramme dissolves in 10 mils of water at 25° C. (77° F.), and in 4 mils of boiling water; insoluble in alcohol.

Tests for Identity.—When heated the crystals decrepitate. At a bright red heat the salt fuses, and at a white heat partial decomposition occurs.

A saturated aqueous solution of the salt yields a white, crystalline precipitate with an excess of sodium bitartrate T.S.

An aqueous solution of the salt (1 in 20) yields with barium chloride T.S. a heavy white precipitate, insoluble in hydrochloric acid.

Impurities and Tests for Impurities.—*Heavy Metals.*—An aqueous solution of Potassium Sulphate does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of the salt meets the requirement of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Dissolve about 0.6 Gm. of Potassium Sulphate, previously dried to constant weight at 100° C. (212° F.), and accurately weighed, in 100 mils of distilled water, acidulate the solution with hydrochloric acid and heat it to boiling. Gradually add an excess of barium chloride T.S. and heat for thirty minutes on a water bath; collect the precipitate of barium sulphate on a filter and wash it with distilled water until silver nitrate T.S. fails to produce an opalescence in 2 mils of the filtrate, previously acidulated with nitric acid. Dry the precipitate, ignite and weigh the residue. It corresponds to not less than 99 per cent. of K_2SO_4.

Each gramme of Potassium Sulphate corresponds to not less than 1.326 Gm. of $BaSO_4$.

N. F. Preparations.—Sal Carolinum Factitium, Sal Carolinum Factitium Effervescens.

Uses.—Because of the hardness of the crystals it was at one time used as the diluent in Dover's Powder on the theory that the labor required to reduce the hard crystals to a fine powder would insure a uniform mixture and fine subdivision of the drug. This use has, however, been abandoned. It is used in laxative salts and extensively employed in the production of potash, alum and potassium carbonate.

Average dose.—15 grains (1 Gm.).

QUESTIONS ON ALKALIES AND THEIR COMPOUNDS AND THE POTASSIUM SALTS

What are alkalies, and what are their properties? (See page 711.)
What are the alkali-metals, and their properties?
How many chlorides are obtained from the alkali-metals?
Are their oxides acid or basic?
Are the alkaline hydroxides decomposable by heat?
What two processes are used for obtaining the alkali-metals?
What is ammonium, and why is it classed with the metals?
What was formerly the source of the potassium salts? (See page 712.)
What is the present source, and how are they obtained?
How may potassium in its combinations be recognized?
Define sulphurated potassa. Give the synonym. How may it be prepared?
Why should the pharmacist frequently prepare it? Describe it.
Give its solubilities.
What are its uses? How may white lotion be made?
Potassium hydroxide—Give formula in symbols and molecular weight.
What percentage of pure potassium hydroxide should it contain?
What is caustic potash or potassa, and how is it made?
What is meant by "potassa by alcohol"?
What is meant by "potassa by barytes"?

What are the physical properties of potassium hydroxide?
How may the following impurities be detected? Organic matter; heavy metals.
Name the official preparations into which it enters.
For what is potassium hydroxide used?
How much water does commercial caustic potassa usually contain?
What is the solution of potassium hydroxide, and how is it made?
What is its Latin official name?
How much potassium hydroxide does it contain?
How may the percentage of potassium hydroxide present be determined?
How strong should the potassium hydroxide be, and if it is not of the proper strength, how may it be used?
By what other process was it formerly made in the U. S. P.?
Explain the chemical reaction which takes place between the lime and the potassium bicarbonate in making this solution.
Why is potassium bicarbonate used in preference to the carbonates (which are cheaper) in preparing this solution?
Is the proportion of water used in making the solution of the bicarbonate a matter of indifference? How much should be used?
Should more than the theoretical quantity of lime be used? Why?
How is this solution injured by exposure to air?
What kind of bottles and stoppers should be used in preserving this solution?
How may this solution be distinguished from solution of soda?
What is its medicinal use? Give the dose.
If a large quantity should be swallowed, what would be the proper antidotes?
Potassium acetate—Give formula in symbols and molecular weight.
How may this salt be made?
Explain the chemical reaction which takes place between potassium bicarbonate and acetic acid.
What are its solubilities? How may it be identified?
What are the tests for the following impurities? Heavy metals; arsenic.
How is it assayed?
What are its uses in medicine? Give its dose. Name its official preparations.
Potassium bicarbonate—Give formula in symbols and molecular weight.
What degree of purity is demanded for the salt? How is it made?
What is salæratus, and how is it prepared?
What are the physical properties of potassium bicarbonate?
What are its solubilities and tests for identity?
How may the following impurities be detected? Carbonate; heavy metals.
Name the official preparations into which it enters.
What are the uses of this salt, and what is the dose?
Cream of tartar—Give official titles, formula in symbols, and molecular weight.
What percentage of purity is required?
How is it made? What is argol?
Give the physical properties of cream of tartar.
What are its solubilities? How may it be identified?
How may the following impurities be detected? Insoluble matter; heavy metals; alum. What amount of lead is permitted? Why is this so carefully restricted?
For what purposes in pharmacy is it used?
Name its official preparations.
What are its medicinal uses? Give the dose.
Potassium bromide—Give formula in symbols and molecular weight.
What process was formerly official for making this salt?
Explain the chemical reaction which takes place.
In what other way may it be made? Explain the reaction which takes place.
Where is this salt manufactured?
Describe its physical properties and solubilities.
How may it be identified?
How may the following impurities be detected? Excess of alkali; bromate; iodide; heavy metals; barium sulphate.
How may it be assayed? Name its official preparations.
What is its medicinal use? Give the dose.
Potassium carbonate—Give formula in symbols and molecular weight.
What is the commercial name of this salt? How is it made?

How may a purer carbonate be produced?
Give the tests for identity.
Describe the physical properties of potassium carbonate.
What are its solubilities?
How much pure anhydrous potassium carbonate should it contain?
How may this be tested?
How may the following impurities be detected? Earthy impurities; heavy metals; moisture.
What is its medicinal use, and what is the dose?
What are its effects in an overdose?
What are the proper antidotes to administer?
Into what official preparations does it enter? What is its chief use?
Potassium chlorate—Give formula in symbols and molecular weight.
How was this formerly made?
What is the objection to this process?
How is it now prepared?
Explain the reactions which take place in its preparations.
Describe its physical properties and solubilities.
How may it be identified?
How may the following impurity be detected? Heavy metals.
What follows when potassium chlorate is triturated with readily oxidizable or combustible substances?
For what is potassium chlorate used chemically?
Name its official preparations.
What is its medicinal use? Give the dose.
Potassium citrate—Give formula in symbols and molecular weight.
How is this salt made?
When made from carbonate instead of potassium bicarbonate, what impurity is apt to be present?
What are its physical properties and solubilities?
How may it be identified?
How may the following impurities be detected? Heavy metals; tartrate; arsenic.
What are its medicinal uses? Give the dose.
Into what official preparations does it enter?
Give the Latin name, formula, and mode of preparation of effervescent potassium citrate.
Why are some of the ingredients directed to be thoroughly dried? What is the dose?
What percentage of potassium citrate should solution of potassium citrate contain? How is it prepared?
Give a description of a properly made solution.
What is "neutral mixture" in some localities?
What is its medicinal use and dose?
Rochelle salt—Give formula in symbols and molecular weight.
What are the Latin and English titles of Rochelle salt?
How is this salt made?
Explain the reaction which takes place.
What is meant by saying that tartaric acid is a dibasic acid?
Describe the physical properties and solubilities of Rochelle salt.
How may its identity be tested?
What are the tests for the following impurities? Heavy metals; ammonia; lead.
Why is the per cent. of lead so carefully restricted?
What is its medicinal use, and what is the dose?
Of what well-known powder is it the most important ingredient?
Potassium hypophosphite—Give formula in symbols and molecular weight. What precaution is given in the U. S. P. about handling it? Why?
How may this salt be prepared? Explain the reaction which takes place.
Should the evaporation of the solution be conducted at a high heat or at a low one? Why?
How may the salt be purified?
Describe its physical properties and solubilities. How may it be identified?
What are the tests for the following impurities? Sulphides; carbonates; arsenic; phosphates.

Into what official preparations does it enter? What is its medicinal use and dose?
Potassium iodide—Give formula in symbols and molecular weight.
How is it prepared, and what reaction takes place?
Should it be crystallized from an acid or an alkaline solution? Why?
How may it be identified? What are its solubilities? How may one fluidounce of a saturated solution be prepared?
What are the tests for the following impurities? Alkali; iodate; heavy metals; barium; sulphate; cyanide.
Name the official preparations in which it is used.
What are its uses, and what is the dose?
Potassium nitrate—Give formula in symbols and molecular weight.
What is a commonly used name for potassium nitrate?
Where does it come from? How is it made?
Describe its physical properties. How may it be identified?
What are the tests for the following impurities? Heavy metals; chlorate and perchlorate.
Name its official preparation.
What are its uses? What is the dose?
Potassium permanganate—Give formula in symbols and molecular weight.
Describe the processes for making this salt.
Explain the reactions which take place in its formation.
Describe its physical properties and solubilities.
How may its identity and purity be tested?
Why is the cautionary official note appended, as follows? "It must not be brought in contact with organic or readily oxidizable substances."
What renders it useful as a disinfectant, and what special care should be used in its application?
How and why is it used chemically?
Potassa with lime—How is this preparation made? For what is it used?
How is effervescent potassium citrate made? Give the dose.
Name the ingredients in compound effervescent potassium bromide.
Potassium chloride—Give the chemical formula and per cent. of required purity.
How is it prepared? Give the tests for identity and purity.
Name its official preparations.
What are its uses and synonyms?
Potassium sulphate—Give formula in symbols and molecular weight.
How is this salt obtained?
Describe its physical properties and solubilities.
How may its identity and purity be tested?
What are the tests for the following impurities? Heavy metals; arsenic.
For what was it formerly used in pharmacy?
What is now used as a substitute for it?

CHAPTER XXX

THE SODIUM SALTS

The sodium salts are generally more frequently used than those having potassium for their base, because they are relatively cheaper, and are often more soluble. The metal *Sodium* is a soft, malleable, ductile solid, which must be protected from the oxygen of the air by being constantly immersed in petroleum or naphtha. It is now largely and cheaply made by electrolysis.

Tests for Sodium Salts.

Sodium may be recognized in its salts by the following reactions:

1. The intensely yellow color produced when even a trace of a sodium compound is introduced into a colorless flame.

2. A reliable and practical precipitant is yet to be discovered for the sodium salts, because the compounds are generally very soluble. Neutral solutions may be precipitated by potassium metantimoniate: this reaction, however, has but a limited application.

3. Sodium salts are generally colorless, and not volatile below a red heat.

U. S. P. Sodium Salts

Official Name	Preparation
With Inorganic Radicals	
Sodii Arsenas	By heating together arsenic trioxide, sodium nitrate, and sodium carbonate
Arsenas Exsiccatus	By drying sodium arsenate until it ceases to lose weight
Bicarbonas	By exposing sodium carbonate to the action of carbon dioxide
Boras	By purifying the native salt
Bromidum	By treating ferrous bromide with sodium carbonate
Carbonas Monohydratus	By crystallizing with agitation a concentrated solution of sodium carbonate at 35° C. (95° F.)
Chloridum	By evaporating sea-water and purifying
Hydroxidum	By boiling solution of sodium carbonate with calcium hydroxide and evaporating
Hypophosphis	By double decomposition between calcium hypophosphite and sodium carbonate
Iodidum	By treating ferrous iodide with sodium carbonate
Nitris	By decomposing sodium nitrate by heating in contact with starch, lead, or other reducing substances
Perboras	By mixing 248 Gm. of boric acid and 78 Gm. of sodium peroxide and pouring the mixture into 2000 mils of cold water, acidified with sulphuric acid, and crystallizing the solution
Phosphas	By treating acid calcium phosphate with sodium carbonate
Phosphas Effervescens	Prepared by mixing finely powdered exsiccated sodium phosphate, sodium bicarbonate, tartaric acid, and citric acid, heating until the whole becomes uniformly moist, granulating, and drying
Phosphas Exsiccatus	Made by drying the phosphate until it ceases to lose weight
Sulphas	By treating common salt with sulphuric acid
Sulphis Exsiccatus	By neutralizing sodium carbonate with sulphurous acid and exsiccating the crystalline product
Thiosulphas	By decomposing calcium thiosulphate with sodium sulphate
With Organic Radicals	
Sodii Acetas	By decomposing sodium carbonate with acetic acid
Benzoa	By decomposing sodium carbonate with benzoic acid
Benzosulphinidum	By neutralizing benzosulphinide with sodium bicarbonate
Cacodylas	By neutralizing an aqueous solution of cacodylic acid with sodium carbonate, evaporating and crystallizing
Citras	By saturating a solution of sodium carbonate with citric acid
Cyanidum	By passing dry ammonia gas over metallic sodium at 350° C. (662° F.) and running the product through red-hot charcoal and by other processes

U. S. P. Sodium Salts—*Continued.*

Official Name	Preparation
With Organic Radicals	
Glycerophosphas	By decomposition between calcium glycerophosphate and sodium carbonate
Indigotindisulphonas	The sodium salt of indigotindisulphonic acid
Phenolsulphonas	By double decomposition between barium phenolsulphonate and sodium carbonate
Salicylas	By decomposing sodium carbonate with salicylic acid

N. F. Sodium Salts

Soda cum Calce	By mixing equal parts of sodium hydroxide and lime
Sodii Boro-Benzoas	By mixing 43 parts of sodium borate with 57 parts of sodium benzoate

Unofficial Sodium Salts

Sodii Bisulphis, $NaHSO_3$ Sodium Bisulphite, U. S. P. VIII	By passing SO_2 into a solution of sodium carbonate until saturated, evaporating and crystallizing
Sodii Chloras, $NaClO_3$ Sodium Chlorate, U. S. P. VIII	By double decomposition between sodium bitartrate and potassium chlorate, evaporating and crystallizing the solution
Sodii Nitras, $NaNO_3$ Sodium Nitrate, U. S. P. VIII	By purifying the native Chili saltpetre
Sodii Phenolas, NaC_6H_5O Sodium Phenolate	Add metallic sodium to phenol, and allow it to crystallize
Sodii Pyrophosphas, $Na_4P_2O_7+10H_2O$ Sodium Pyrophosphate, U. S. P. VIII	By heating sodium phosphate to redness, dissolving the residue in water and crystallizing
Sodii-Citro-Tartras Effervescens Effervescent Sodium Citro-tartrate	17 parts sodium bicarbonate; 8 parts tartaric acid; 6 parts citric acid. Mix, and place in a dish heated to about 93.3° C. (200° F.). Stir constantly until a granular salt is obtained. Lastly, sift it
Sodii et Ammonii Phosphas $NH_4NaHPO_4+4H_2O$ Sodium and Ammonium Phosphate	Dissolve 5 parts crystallized sodium phosphate and 2 parts ammonium phosphate in 20 parts hot water; then add ammonia water until the liquid is alkaline, and crystallize
Sodii et Argenti Thiosulphas $2Na_2S_2O_3+Ag_2S_2O_3$ Sodium and Silver Thiosulphate	Dissolve freshly precipitated silver oxide in a solution of sodium thiosulphate, evaporate and crystallize
Sodii Ethylas, C_2H_5NaO Sodium Ethylate	Caustic. Used in alcoholic solution; also applied externally mixed with olive oil
Sodii Ethylsulphas, $C_2H_5NaSO_4+H_2O$ Sodium Ethylsulphate, Sodium Sulphovinate	Cathartic
Sodii Nitro-Prussidum $Na_2Fe(CN)_5NO+2H_2O$ Sodium Nitro-Prusside	Digest 1 part potassium ferrocyanide with 2 parts nitric acid and 2 parts water until it ceases to produce a blue precipitate with iron salts. When cool, neutralize the mother liquor with sodium carbonate, then collect the red crystals
Sodii et Platini Chloridum $2NaCl.PtCl_4+6H_2O$ Sodium and Platinum Chloride	Dissolve 3 parts platinic chloride and 5 parts sodium chloride in water, and evaporate to dryness, stirring continually
Sodii Silicas, Na_2SiO_3 Sodium Silicate, Water Glass, Soluble Glass	Mix 1 part silica and 2 parts dried sodium carbonate; fuse in an earthenware crucible, and pour the mass on a slab. Dissolve in water, filter, concentrate, and crystallize
Sodii Silicofluoridum, Na_2SiF_6 Sodium Silico-Fluoride	Antiseptic. A mild caustic
Sodii Stannas, Na_2SnO_3 Sodium Stannate	Fuse tin ore with caustic soda and sodium nitrate
Sodii Sulphobenzoas, $C_6H_4(NaSO_3)COONa$ Sodium Sulphobenzoate	Non-poisonous antiseptic
Sodii Tartras, $Na_2C_4H_4O_6+2H_2O$ Sodium Tartrate	Dissolve 6 parts tartaric acid and 7½ parts sodium bicarbonate, each separately, in water. Mix solutions, filter, concentrate, and crystallize
Sodii Valeras, $NaC_5H_9O_2$ Sodium Valerate	Saturate valeric acid with sodium carbonate

SODII HYDROXIDUM. U. S. Sodium Hydroxide

[Sod. Hydrox.—CAUSTIC SODA SODIUM HYDRATE]

It contains not less than 90 per cent. of NaOH (40.01). Preserve it in well-closed containers. If bottles are used as containers they must be made of hard glass.

Preparation.—Owing to the improvements in the manufacture of metallic sodium and the cheapening of the product, sodium hydroxide can be found in commerce which has been made by oxidizing the metal by bringing it in contact with water and evaporating the pure solution of sodium hydroxide. It is also prepared by boiling an aqueous solution of sodium carbonate and milk of lime until the clear liquid no longer effervesces with acids, decanting, then evaporating the clear liquid, in iron dishes, to a specific gravity of 1.170, concentrating in a silver dish and finally pouring the solution into silver moulds. When the pure hydroxide is not needed, the white caustic sodium hydroxide, in sticks, made by evaporating a solution of sodium hydroxide (see Liquor Sodii Hydroxidi) and casting the fused residue into moulds, is used. (See Potassii Hydroxidum, page 715.)

The reaction is as follows:

$$\underset{\substack{\text{Sodium}\\ \text{Carbonate}}}{Na_2CO_3} + \underset{\substack{\text{Calcium}\\ \text{Hydroxide}}}{Ca\ (OH)_2} = \underset{\substack{\text{Sodium}\\ \text{Hydroxide}}}{2NaOH} + \underset{\substack{\text{Calcium}\\ \text{Carbonate}}}{CaCO_3}$$

Official Description.—It occurs as dry, white, or nearly white, fused masses, or sticks, hard and brittle, showing a crystalline fracture. *Great caution is necessary in using it,* as it rapidly destroys organic tissues. Exposed to the air, it deliquesces, absorbs carbon dioxide, and becomes covered with a coating of carbonate.

Odor and Reaction.—Odorless; a solution of Sodium Hydroxide even when greatly diluted is strongly alkaline to litmus.

Solubility.—One Gm. of Sodium Hydroxide dissolves in 0.9 mil of water at 25° C. (77° F.), also in about 0.3 mil of boiling water: very soluble in alcohol.

Tests for Identity.—When introduced into a non-luminous flame, it imparts to it an intensely yellow color.

Impurities and Tests for Impurities.—*Organic matter or insoluble impurities.*—An aqueous solution of Sodium Hydroxide (1 in 20) is clear and colorless, and

Potassium.—After being acidulated with acetic acid, it yields no precipitate on the addition of an excess of tartaric acid T.S., or upon the addition of a few drops of sodium cobaltic nitrite T.S.

Heavy Metals.—An aqueous solution of Sodium Hydroxide (1 in 50), slightly acidulated with hydrochloric acid, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dissolve in a 500-mil graduated flask about 10 Gm. of Sodium Hydroxide, accurately weighed in a glass-stoppered weighing-bottle, in 250 mils of distilled water, which has previously been boiled and cooled, and add 15 mils of barium chloride T.S. Fill the flask to the mark with distilled water, which has previously been boiled and cooled, and thoroughly agitate the liquid. Filter it through a dry filter into a dry flask (rejecting the first 20 mils) and titrate 100 mils of the clear filtrate with normal hydrochloric acid V.S., using phenolphthalein T.S. as indicator. It shows not less than 90 per cent. of NaOH.

Each mil of normal hydrochloric acid V.S. used corresponds to 0.04001 Gm. of NaOH. Each gramme of Sodium Hydroxide corresponds to not less than 22.5 mils of normal hydrochloric acid V.S.

U. S. P. Preparations.—Liquor Cresolis Compositus; Liquor Sodii Hydroxidi; Magma Magnesiæ.

N. F. Preparation.—Soda cum Calce.

Uses.—*Caustic Soda,* as sodium hydroxide is termed commercially, is sometimes preferred to the analogous potassium salt, in the belief that it is milder and less deliquescent. It is usually less expensive than the potassium salt and is used in smaller amounts because of its smaller molecular weight. This is well illustrated in the official Compound Solution of Cresol where the 80 Gm. of potassium hydroxide may be replaced by 54 Gm. of sodium hydroxide. Its chief pharmaceutical uses are indicated under the preparations.

LIQUOR SODII HYDROXIDI. U. S. **Solution of Sodium Hydroxide**

[Liq. Sod. Hydrox.—Liquor Sodæ Solution of Soda]

An aqueous solution containing not less than 4.5 per cent. of NaOH (40.01). Preserve Solution of Sodium Hydroxide in bottles made of hard glass and provided with rubber stoppers or with glass stoppers coated with petrolatum.

	Metric	Old form
***Sodium Hydroxide**	**56 Gm.**	1 oz. av.
Distilled Water	**944 Gm.**	15 fl. oz.
To make	**1000 Gm.**	1 pint

Dissolve the sodium hydroxide in the distilled water.

The sodium hydroxide used in this process should be of the full strength and quality directed by the Pharmacopœia (90 per cent.). Sodium hydroxide of any other strength, however, may be used, if a proportionately larger or smaller quantity be taken, the proper amount for the above formula being ascertained by dividing 5040 by the percentage of absolute sodium hydroxide contained therein.

Solution of Sodium Hydroxide should be kept in bottles made of green glass, and provided with glass stoppers coated with paraffin or petrolatum.

This solution was directed to be made in the U. S. P. 1890 by a method similar to that for preparing the solution of potassium hydroxide (see page 716).

Official Description.—A clear, colorless liquid.

Odor, Taste, and Reaction.—Odorless; having, when diluted, a very acrid and caustic taste. *It should not be tasted unless largely diluted.* It is strongly alkaline and readily absorbs carbon dioxide from the air.

Specific Gravity.—About 1.056 at 25° C. (77° F.).

Tests for Identity and Impurities.—It conforms to the reactions and tests for an aqueous solution of sodium hydroxide as given under *Sodii Hydroxidum*, when concentrated to the proper strength.

Carbonate.—Introduce about 20 mils of Solution of Sodium Hydroxide into a flask, stopper, weigh accurately and titrate it directly with normal hydrochloric acid V.S., using methyl orange T.S. as indicator. It shows not more than 5.5 per cent. of alkalinity, calculated as NaOH.

Assay.—Transfer about 50 mils of Solution of Sodium Hydroxide, accurately weighed, to a 250-mil measuring-flask, add 20 mils of barium chloride T.S. and fill the flask to the mark with distilled water, which has been previously boiled and cooled. Then thoroughly agitate the liquid, filter it through a dry filter, reject the first 20 mils, and titrate 100 mils of the clear filtrate with normal hydrochloric acid V.S., using phenolphthalein T.S. as indicator. It shows not less than 4.5 per cent. of NaOH when calculated to the amount of solution originally taken.

Each mil of normal hydrochloric acid V.S. used corresponds to 0.04001 Gm. of NaOH. Each gramme of Solution of Sodium Hydroxide corresponds to not less than 1.12 mils of normal hydrochloric acid V.S.

Uses.—Solution of sodium hydroxide is an antacid, and is used for the same purposes as solution of potassium hydroxide (see page 716) in the dose of 15 minims (1 mil).

SODII ACETAS. U. S. **Sodium Acetate**

[Sod. Acet.]

It contains not less than 59.97 per cent. nor more than 62.96 per cent. of anhydrous sodium acetate, corresponding to not less than 99.5 per cent. of the crystallized salt [$NaC_2H_3O_2+3H_2O=136.07$]. Preserve it in well-closed containers.

Preparation.—This salt is obtained on the large scale in the process for making acetic acid. For medicinal purposes it may be made conveniently by saturating acetic acid with sodium carbonate, filtering the solution, concentrating it, and obtaining the salt in crystals.

$$\underset{\substack{\text{Acetic}\\\text{Acid}}}{2HC_2H_3O_2} + \underset{\substack{\text{Sodium}\\\text{Carbonate}}}{Na_2CO_3} = \underset{\substack{\text{Sodium}\\\text{Acetate}}}{2NaC_2H_3O_2} + \underset{\text{Water}}{H_2O} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{CO_2}$$

It is sometimes granulated, and in this form it is more convenient for dispensing purposes than the usual large crystals.

Official Description.—Colorless, transparent, monoclinic prisms, or a granular, crystalline powder.

Odor, Taste, and Reaction.—Odorless, or having a faint, acetous odor. It has a cooling, saline taste. Efflorescent in warm, dry air. An aqueous solution of the salt (1 in 20) is neutral or slightly alkaline to litmus or phenolphthalein T.S.

Solubility.—One Gm. of Sodium Acetate dissolves in 0.8 mil of water and in 19 mils of alcohol at 25° C. (77° F.).

Tests for Identity.—When heated to about 58° C. (136.4° F.), the salt begins to liquefy. At about 120° C. (248° F.), it becomes anhydrous; at a higher temperature it is decomposed, with the evolution of inflammable, empyreumatic vapors, leaving a black residue of sodium carbonate and carbon, which imparts to a non-luminous flame an intensely yellow color, shows an alkaline reaction with litmus, and effervesces with acids.

Add 0.1 Gm. of the salt to 1 mil of sulphuric acid and 1 mil of alcohol and warm: ethyl acetate is formed, recognizable by its odor.

Impurities and Tests for Impurities.—*Potassium.*—A saturated aqueous solution of the salt is not rendered turbid by the addition of sodium bitartrate T.S.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of the salt meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Proceed as directed under the Assay for alkali salts of organic acids (see Part II, Test No. 6). It shows not less than 59.97 per cent. nor more than 62.96 per cent. of $NaC_2H_3O_2$.

Each mil of half-normal sulphuric acid V.S. used corresponds to 0.04101 Gm. of $NaC_2H_3O_2$. Each gramme of Sodium Acetate corresponds to not less than 14.62 mils nor more than 15.35 mils of half-normal sulphuric acid V.S.

Uses.—Sodium acetate is often preferred to potassium acetate as a diuretic. It is not deliquescent like the latter, and is said to be as efficient, although milder in its action. The dose is from fifteen to sixty grains (1 to 4 Gm.).

SODII ARSENAS. U. S. Sodium Arsenate

[**Sod. Arsen.**—Arsenas Sodii P.I.]

It contains not less than 58.98 per cent. nor more than 61.92 per cent. of anhydrous sodium arsenate (di-sodium ortho-arsenate), corresponding to not less than 99 per cent. of the crystallized salt [$Na_2HAsO_4+7H_2O=312.08$]. Preserve it in well-closed containers.

Preparation.—A process for this salt was formerly official; it is as follows:

Take of arsenic trioxide, in fine powder, 960 *grains;* sodium nitrate in fine powder, 816 *grains;* dried sodium carbonate, in fine powder, 528 *grains;* distilled water, boiling hot, *half a pint.* Having mixed the powders thoroughly, put the mixture into a large clay crucible, and cover it with the lid. Expose it to a full red heat until effervescence has ceased and complete fusion has taken place. Pour the fused salt on a porcelain slab, and as soon as it has solidified, and while it is still warm, put it into the hot water, and stir until it is dissolved. Filter the solution, and set it aside to crystallize. Drain the crystals, and, having dried them rapidly on filter paper, keep them in a well-stoppered bottle.

The rationale of this process is that when arsenic trioxide, sodium nitrate, and sodium carbonate are fused together, sodium pyroarsenate is formed, while nitrous anhydride and carbon dioxide escape as gases.

$$\underset{\substack{\text{Arsenic}\\\text{Trioxide}}}{As_2O_3} + \underset{\substack{\text{Sodium}\\\text{Nitrate}}}{2NaNO_3} + \underset{\substack{\text{Sodium}\\\text{Carbonate}}}{Na_2CO_3} = \underset{\substack{\text{Sodium}\\\text{Pyroarsenate}}}{Na_4As_2O_7} + \underset{\substack{\text{Nitrous}\\\text{Anhydride}}}{N_2O_3} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{CO_2}$$

Sodium pyroarsenate is converted into the orthoarsenate (the official salt) by dissolving the former in water, filtering the solution, and crystallizing.

$$\underset{\substack{\text{Sodium}\\\text{Pyroarsenate}}}{Na_4As_2O_7} + \underset{\text{Water}}{15H_2O} = \underset{\substack{\text{Sodium}\\\text{Orthoarsenate}}}{2(Na_2HAsO_4{,}7H_2O)}$$

Official Description.—Colorless, transparent, monoclinic prisms.

Odor and Taste.—Odorless; efflorescent in dry air, and somewhat deliquescent in moist air. *Great caution must be used in tasting it and then only in very dilute solutions.*

Solubility.—One Gm. of Sodium Arsenate dissolves in 1.5 mils of water at 25° C. (77° F.); also in about 1 mil of boiling water; slightly soluble in alcohol at 25° C. (77° F.); nearly insoluble in boiling alcohol.

Tests for Identity and Impurities.—When gently heated, the salt loses five molecules of water, and is converted into a white powder. At a higher temperature it loses all of its water of crystallization; when strongly heated, the salt fuses, and at a red heat it is converted into pyroarsenate.

Sodium Arsenate responds to the tests for identity and purity prescribed under *Sodii Arsenas Exsiccatus* when taken in proportionate amount.

Assay.—Dissolve about 0.5 Gm. of Sodium Arsenate, accurately weighed, in 25 mils of distilled water, heat the solution to 80° C. (176° F.) and add 10 mils of hydrochloric acid and 3 Gm. of potassium iodide. Allow the mixture to stand for fifteen minutes at 80° C. (176° F.); then cool and titrate it with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator. It shows not less than 58.98 per cent. nor more than 61.92 per cent. of Na_2HAsO_4.

Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.0092985 Gm. of Na_2HAsO_4. Each gramme of Sodium Arsenate corresponds to not less than 63.44 mils nor more than 66.59 mils of tenth-normal sodium thiosulphate V.S.

U. S. P. Preparation.—Sodii Arsenas Exsiccatus.

Uses.—The only advantage in using this salt in preference to arsenic trioxide is that the practitioner is more apt to get it of uniform quality; their properties are identical. The dose is from one-twelfth to one-third of a grain (0.005 to 0.02 Gm.).

SODII ARSENAS EXSICCATUS. U. S. Exsiccated Sodium Arsenate

[Sod. Arsen. Exsic.]

It contains, when dried to constant weight at 150° C. (302° F.), not less than 98 per cent. of Na_2HAsO_4 (185.97). Preserve it in well-closed containers.

***Sodium Arsenate**, in crystals, *a sufficient quantity.*

Break the crystals into small fragments, and allow them to effloresce at a temperature between 40° and 50° C. (104° and 122° F.), until they are completely disintegrated; then gradually increase the temperature to 150° C. (302° F.), and continue the drying until the product ceases to lose weight. Reduce it to a fine powder, and transfer it to dry, well-closed containers.

Official Description.—Amorphous, white powder. It is slightly hygroscopic.

Odor, Taste, and Reaction.—Odorless. *Great caution must be used in tasting it and then only in very dilute solutions.* Its aqueous solution (1 in 20) is alkaline to litmus.

Solubility.—One Gm. of Exsiccated Sodium Arsenate dissolves in 3.1 mils of water at 25° C. (77° F.); also in about 1.3 mils of boiling water; slightly soluble in alcohol at 25° C. (77° F.), nearly insoluble in boiling alcohol.

Tests for Identity.—It imparts an intensely yellow color to a non-luminous flame. An aqueous solution of the salt (1 in 20) yields a white precipitate with barium chloride T.S., and a dark red precipitate with silver nitrate T.S.; both of these precipitates are soluble in nitric acid.

Impurities and Tests for Impurities.—*Arsenite.*—Add 5 mils of tenth-normal silver nitrate V.S. to 2 mils of an aqueous solution of the salt (1 in 20) and redissolve the precipitate with the aid of a slight excess of ammonia water; no black precipitate of reduced silver appears on boiling for one minute.

Lead, Copper, or Iron.—Add 1 mil of ammonium sulphide T.S. to 5 mils of an aqueous solution of the salt (1 in 100); no dark coloration appears.

Assay.—Dissolve about 0.3 Gm. of Exsiccated Sodium Arsenate, dried to constant weight at 150° C. (302° F.) and accurately weighed, in 25 mils of distilled water, in a glass-stoppered bottle, heat the solution to 80° C. (176° F.) and add 10 mils of hydrochloric acid and 3 Gm. of potassium iodide. Allow the mixture to stand in the stoppered bottle for fifteen minutes at 80° C. (176° F.), then cool and titrate it with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator. It shows, in the dried salt, not less than 98 per cent. of Na_2HAsO_4.

Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.0092985 Gm. of Na_2HAsO_4. Each gramme of Exsiccated Sodium Arsenate, previously dried, corresponds to not less than 105.4 mils of tenth-normal sodium thiosulphate V.S.

U. S. P. Preparation.—Liquor Sodii Arsenatis.

N. F. Preparation.—Liquor Sodii Arsenatis, Pearson.

Uses.—Exsiccated Sodium Arsenate is used in making the official solutions (see above). The advantage in using it in preference to sodium arsenate is that greater definiteness is secured; the latter salt as found in commerce is more or less effloresced, and the solution if made from it would be variable in its arsenical strength. Sixty parts of exsiccated sodium arsenate represent about 100 parts of the official crystallized salt. The *dose* is one-twentieth grain (0.003 Gm.).

SODII BENZOAS. U. S. Sodium Benzoate
[Sod. Benz.]

It contains, when dried to constant weight at 110° C. (230° F.) not less than 99 per cent. of $NaC_7H_5O_2$ (144.04). Preserve it in well-closed containers.

Preparation.—Benzoic acid is added to a hot concentrated solution of pure sodium carbonate until effervescence ceases. The solution is evaporated, cooled, and allowed to crystallize, or, preferably, evaporated to dryness and granulated.

$$\underset{\text{Benzoic Acid}}{2HC_7H_5O_2} + \underset{\substack{\text{Sodium}\\\text{Carbonate}}}{Na_2CO_3} = \underset{\substack{\text{Sodium}\\\text{Benzoate}}}{2NaC_7H_5O_2} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{CO_2} + \underset{\text{Water}}{H_2O}$$

The yield of granulated salt is about one and one-third times the quantity of benzoic acid used.

Official Description.—A white, amorphous, granular or crystalline powder; permanent in the air.

Odor, Taste, and Reaction.—Odorless, and having a sweetish taste. An aqueous solution of Sodium Benzoate (1 in 20) is neutral or slightly alkaline to litmus.

Solubility.—One Gm. of Sodium Benzoate dissolves in 1.8 mils of water and in 61 mils of alcohol at 25° C. (77° F.); also in 1.4 mils of boiling water.

Tests for Identity.—When heated, the salt melts, emits vapors having the odor of benzoic acid, then chars, and finally leaves a residue of sodium carbonate and carbon. To a non-luminous flame it imparts an intensely yellow color.

Add a few drops of ferric chloride T.S. to an aqueous solution of the salt (1 in 20); a flesh-colored precipitate is deposited.

Diluted hydrochloric or sulphuric acid produces in a concentrated aqueous solution of the salt a voluminous white precipitate of benzoic acid.

Impurities and Tests for Impurities.—*Heavy Metals.*—Acidulate 10 mils of an aqueous solution of the salt (1 in 50) with hydrochloric acid and filter; the filtrate does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dry the salt to constant weight at 110° C. (230° F.), and proceed as directed under the Assay for alkali salts of organic acids (see U. S. P., Test No. 6, Chapter LXII). It shows, in the dried salt, not less than 99 per cent. of $NaC_7H_5O_2$.

Each mil of half-normal sulphuric acid V.S. used corresponds to 0.07202 Gm. of $NaC_7H_5O_2$. Each gramme of Sodium Benzoate, previously dried, corresponds to not less than 13.75 mils of half-normal sulphuric acid V.S.

N. F. Preparations.—Liquor Antisepticus; Liquor Antisepticus Alkalinus; Sodii Boro-Benzoas.

Uses.—Sodium benzoate has been prescribed as a remedy in phthisis, diphtheria, and similar complaints, in fifteen-grain doses (1 Gm.). It is also employed in rheumatism and is extensively used as a food preservative.

SODII BICARBONAS. U. S. Sodium Bicarbonate
[Sod. Bicarb.]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99 per cent. of $NaHCO_3$ (84.01). Preserve it in well-closed containers, in a cool place.

Preparation.—All the processes for making this important salt of sodium, with one exception, consist in the addition of carbon dioxide to sodium carbonate. This operation cannot be carried on profitably upon the small scale; but the pharmacist could buy commercial sodium bicarbonate and purify it for dispensing purposes (see page 747), although to-day a salt of a high degree of purity, complying with all of the U. S. P. tests, may be purchased at a price which would not justify its purification on the small scale. Crystallized sodium carbonate contains ten molecules of water of crystallization; sodium bicarbonate contains none, hence provision must be made for the escape of this water, which is thrown out of combination during the process of carbonating. The crystallized sodium carbonate is placed upon false bottoms in chambers arranged so that the water can escape as it is liberated.

$$\underset{\text{Sodium Carbonate}}{Na_2CO_3} + \underset{\text{Carbon Dioxide}}{CO_2} + \underset{\text{Water}}{H_2O} = \underset{\text{Sodium Bicarbonate}}{2HNaCO_3}$$

Sodium bicarbonate is more largely prepared by the ammonia-soda process, or *Solvay's*, as it is usually called. In this, carbon dioxide is passed into a solution of common salt in ammonia water, double decomposition ensues, sodium bicarbonate is precipitated, and ammonium chloride, being very soluble, remains in solution.

$$\underset{\text{Sodium Chloride}}{NaCl} + \underset{\text{Ammonia}}{NH_3} + \underset{\text{Carbon Dioxide}}{CO_2} + \underset{\text{Water}}{H_2O} = \underset{\text{Sodium Bicarbonate}}{HNaCO_3} + \underset{\text{Ammonium Chloride}}{NH_4Cl}$$

Formerly commercial sodium bicarbonate contained small quantities of impurities having a disagreeable alkaline taste, such as sodium carbonate, chloride, and sulphate, and ammonium salts. These are much more soluble than the bicarbonate, and are easily washed out with distilled water without serious loss of the bicarbonate. At that time it was customary for the pharmacists to purify the commercial bicarbonate, but to-day, because of the enormous use of this salt in baking powder and the necessity for its being of a high degree of purity for that purpose, there is no difficulty in obtaining sodium bicarbonate of U. S. P. standard and at a low cost.

Official Description.—A white, opaque powder; permanent in dry air, but slowly decomposed in moist air.

Odor, Taste, and Reaction.—Odorless, and having a cooling, mildly alkaline taste. An aqueous solution of Sodium Bicarbonate (1 in 20) when freshly prepared with cold distilled water, without shaking, is slightly alkaline to litmus. The alkalinity increases by standing, agitation, or increase in temperature.

Solubility.—One Gm. of Sodium Bicarbonate dissolves in 10 mils of water at 25° C. (77° F.); insoluble in alcohol.

Tests for Identity.—When heated above 15° C. (59° F.), an aqueous solution of the salt gradually loses carbon dioxide, and at boiling temperature the salt is entirely converted into normal sodium carbonate.

When heated, the salt is decomposed into normal sodium carbonate, water, and carbon dioxide, and at 100° C. (212° F.), the loss is about 36.5 per cent. of its weight. At a bright red heat the residue fuses. To a non-luminous flame it imparts an intensely yellow color.

An aqueous solution of the salt effervesces strongly with acids.

Impurities and Tests for Impurities.—No odor of ammonia is evolved on heating Sodium Bicarbonate in a test tube.

Dissolve 1 Gm. of the salt in 20 mils of distilled water at 25° C. (77° F.); it yields a clear and colorless solution, leaving no residue.

Carbonate.—Dissolve 1 Gm. of the salt without agitation in 20 mils of distilled water at a temperature not exceeding 15° C. (59° F.), and add 0.2 mil of normal hydrochloric acid and 2 drops of phenolphthalein T.S.; a red tint does not appear immediately.

Heavy Metals.—An aqueous solution of the salt (1 in 50), mixed with a slight excess of hydrochloric acid, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Mix about 3 Gm. of Sodium Bicarbonate, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed, with 25 mils of distilled water and titrate with normal sulphuric acid V.S., methyl orange T.S. being used as indicator. It shows, in the dried salt, not less than 99 per cent. of $NaHCO_3$.

Each mil of normal sulphuric acid V.S. used corresponds to 0.08401 Gm. of $NaHCO_3$. Each gramme of Sodium Bicarbonate, previously dried, corresponds to not less than 11.78 mils of normal sulphuric acid V.S.

U. S. Preparations.—Caffeina Citrata Effervescens; Potassii Citras Effervescens; Pulvis Effervescens Compositus; Sodii Phosphas Effervescens; Trochisci Sodii Bicarbonatis.

N. F. Preparations.—Liquor Pancreaticus; Liquor Sodæ et Menthæ; Liquor Sodii Boratis Compositus; Mistura Rhei Composita; Pulvis Acetanilidi Compositus; Pulvis Pancreatini Compositus; Sal Carolinum Factitium; Sal Carolinum Factitium Effervescens; Sal Kissingense Factitium; Sal Kissingense Factitium Effervescens; Sal Lithii Citras Effervescens; Sal Potassii Bromidi Effervescens; Sal Potassii Bromidi Effervescens Compositus; Sal Vichyanum Factitium; Sal Vichyanum Factitium Effervescens; Sal Vichyanum Factitium Effervescens cum Lithio.

Uses.—Sodium bicarbonate is largely used as a safe antacid, in doses of ten to fifteen grains (0.65 to 1 Gm.). It is preferably administered in carbonic acid water, and the draught is popularly known as "extra soda." The misnomer is caused by the erroneous use of the term "soda water."

SODII BENZOSULPHINIDUM. U. S. Sodium Benzosulphinide

[**Sod. Benzosulphin.**—SODIUM-SACCHARIN SOLUBLE SACCHARIN]

The sodium salt [$NaC_7H_4O_3NS+2H_2O=241.14$] of benzosulphinide. Preserve it in well-closed containers.

Preparation.—It is prepared by neutralizing ortho-sulphamidobenzoic acid or "saccharin" with sodium bicarbonate.

Official Description.—In colorless, rhombic prisms or a white, crystalline powder, somewhat efflorescent.

Odor, Taste, and Reaction.—Odorless or having a faint aromatic odor and an intensely sweet taste, even in dilute solutions. An aqueous solution of the salt (1 in 10) is neutral or only slightly alkaline to litmus, but produces no red color with phenolphthalein T.S.

Solubility.—One Gm. of Sodium Benzosulphinide dissolves in 1.2 mils of water, and in about 50 mils of alcohol at 25° C. (77° F.).

Tests for Identity.—On incineration the salt leaves a residue consisting chiefly of sodium sulphate.

Mix 10 mils of an aqueous solution of the salt (1 in 10) with 1 mil of hydrochloric acid; a crystalline precipitate of benzosulphinide is produced.

Impurities and Tests for Impurities.—*Benzoate or Salicylate.*—Add a few drops of ferric chloride T.S. to 10 mils of an aqueous solution of the salt (1 in 20) previously acidulated with from 3 to 5 drops of acetic acid; no pink or violet precipitate is produced.

In other respects it responds to the tests for identity and purity under *Benzosulphinidum*, omitting the melting point and the tests for ash, benzoic acid or salicylic acid.

N. F. Preparation.—Trochisci Quininæ Tannatis.

Uses.—It is used as a sweetening substance, chiefly when a patient is suffering from diabetes or other serious complaints, in which sugar is contra-indicated. The sodium salt is more readily soluble than benzosulphinide (see page 1008) but does not possess quite an equal sweetening power, benzosulphinide being five hundred times sweeter than sugar, and the sodium salt about four hundred times. It is given in doses of one-half to three grains (0.03 to 0.2 Gm.). Its use as a sweetening agent in beverages and food is prohibited by the Food and Drugs Act and by many State laws.

SODII BORAS. U. S. Sodium Borate

[**Sod. Bor.**—BORAX SODIUM TETRABORATE SODIUM PYROBORATE]

It contains not less than 52.32 per cent. nor more than 54.92 per cent. of anhydrous sodium borate (sodium biborate or tetraborate), corresponding to not less than 99 per cent. of the crystallized salt [$Na_2B_4O_7+10H_2O=382.16$]. Preserve it in well-closed containers.

Preparation.—This salt is found in immense quantities in California as a crystalline deposit at Clear Lake and near Death Valley. It is probable that this will continue to be the principal source of borax for many years to come. The process of purification consists simply in picking the large and perfect crystals out, washing them, and lixiviating the earth, which is strongly impregnated with borax, evaporating the solution, and crystallizing. It is sometimes called *biborate of sodium.* It is also found as *calcium borate,* or "cotton balls," in the borax mines of California, and sodium borate is obtained by double decomposition by treating the solution of calcium borate with sodium carbonate. Borax is found native in Thibet, Persia, and other localities. It is sometimes called *tincal.* Crude boric acid, obtained from Tuscany, is fused with dried sodium carbonate, and a hot solution of the residue is crystallized in order to produce borax.

Official Description.—Colorless, transparent, monoclinic prisms, or as a white powder; it is slightly efflorescent in warm, dry air.

Odor, Taste, and Reaction.—Odorless, and having a sweetish, alkaline taste.

Solubility.—One Gm. of Sodium Borate dissolves in 15 mils of water, and in about 1 mil of glycerin at 25° C. (77° F.); also in 0.6 mil of boiling water; insoluble in alcohol.

An aqueous solution of the salt (1 in 20) is alkaline to litmus and turns turmeric paper reddish-brown. If the solution has been acidulated with hydrochloric acid, turmeric paper remains unchanged at first, but on drying becomes brownish-red, and this color is temporarily changed to greenish-black by moistening with ammonia water.

Tests for Identity.—When heated, the salt at first loses part of its water of crystallization, then melts, and, when further heated, swells and forms a white porous mass.

At a red heat it loses all of its water of crystallization and fuses to a colorless glassy mass. To a non-luminous flame it imparts an intensely yellow color.

Form a bead of borax on a platinum wire, dip it in glycerin, and hold it in a non-luminous flame; a transient, bright green color appears.

Impurities and Tests for Impurities.—*Carbonate or Bicarbonate.*—An aqueous solution of the salt (1 in 20) does not effervesce with acids.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of the salt meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Dissolve about 5 Gm. of Sodium Borate, accurately weighed, in 100 mils of distilled water and titrate the solution with normal hydrochloric acid V.S., methyl orange T.S. being used as indicator. It shows not less than 52.32 per cent. nor more than 54.92 per cent. of $Na_2B_4O_7$.

Each mil of normal hydrochloric acid V.S. used corresponds to 0.1010 Gm. of $Na_2B_4O_7$. Each gramme of Sodium Borate corresponds to not less than 5.18 mils nor more than 5.44 mils of normal hydrochloric acid V.S.

U. S. P. Preparation.—Unguentum Aquæ Rosæ.

N. F. Preparations.—Liquor Antisepticus Alkalinus; Liquor Sodii Boratis Compositus; Mel Rosæ et Sodii Boratis; Mel Sodii Boratis; Sodii Boro-Benzoas.

Uses.—Borax, as it is almost universally called, is antacid and diuretic. It enters into many mouth washes, and is frequently applied in the form of powder to ulcers in the mouth, for which purpose it is admirably adapted, being mildly alkaline and not very soluble. It is used enormously in the household as an ingredient in soaps, cleansers, etc. Pharmaceutically, it is frequently used in small quantity to whiten ointments, particularly the ointment of rose water. It is used for this purpose by dissolving it in water, and incorporating the solution. The dose is eight to twelve grains (0.5 to 0.77 Gm.).

SODII BROMIDUM. U. S. Sodium Bromide
[Sod. Brom.]

It contains, when dried to constant weight at 100° C. (212° F.), not less than 98.5 per cent. of NaBr (102.92). Preserve it in well-closed containers.

Preparation.—The process most used in making this salt is by decomposing ferrous bromide by treating it with sodium carbonate. The ferrous bromide is made by acting on iron wire with bromine in the presence of water, and, after filtering the solution, adding solution of sodium carbonate. The reaction may be thus expressed:

$$\underset{\substack{\text{Ferrous}\\ \text{Bromide}}}{FeBr_2} + \underset{\substack{\text{Sodium}\\ \text{Carbonate}}}{Na_2CO_3} = \underset{\substack{\text{Sodium}\\ \text{Bromide}}}{2NaBr} + \underset{\substack{\text{Ferrous}\\ \text{Carbonate}}}{FeCO_3}$$

Sodium bromide may also be made by a method similar to that outlined under potassium bromide (see page 721) in which bromine and sodium hydroxide are combined to form sodium bromide and bromate, the latter being afterward converted into bromide by fusion with charcoal or by first producing ammonium bromide by treating a solution of ammonia with bromine (see Ammonii Bromidum), and then by double decomposition with sodium carbonate, forming sodium bromide and ammonium carbonate. The solution, by careful evaporation and granulation, may be made to yield sodium bromide, while ammonium carbonate, being composed of volatile compounds, is dissipated by the amount of heat used to granulate the sodium salt.

Official Description.—Colorless or white, cubical crystals, or a white, granular powder; the salt absorbs moisture from the air without deliquescing.

Odor, Taste, and Reaction.—Odorless, and having a saline taste. An aqueous solution of the salt (1 in 20) is neutral or faintly alkaline to litmus.

Solubility.—One Gm. of Sodium Bromide dissolves in 1.1 mils of water and in 16 mils of alcohol at 25° C. (77° F.).

Tests for Identity.—When heated to a bright red heat, the salt fuses without decomposition, and at a somewhat higher temperature it volatilizes. To a non-luminous flame it imparts an intensely yellow color.

Silver nitrate T.S., added to an aqueous solution of the salt (1 in 10), produces a yellowish-white precipitate, insoluble in nitric acid or in a moderate excess of ammonia water.

Impurities and Tests for Impurities.—*Alkali.*—Dissolve 1 Gm. of the salt in 10 mils of distilled water and add 0.1 mil of tenth-normal sulphuric acid V.S.; no color is produced by the subsequent addition of a drop of phenolphthalein T.S., even after boiling.

Iodide.—Add a few drops of ferric chloride T.S. and 1 mil of chloroform to 10 mils of an aqueous solution of the salt (1 in 20) and shake the mixture; the chloroform does not acquire a violet tint.

Bromate.—Drop 1 mil of diluted sulphuric acid on about 1 Gm. of the powdered salt; no yellow color appears at once.

Barium.—Ten mils of an aqueous solution of the salt (1 in 20), when acidulated with hydrochloric acid, is not rendered turbid by the addition of 1 mil of potassium sulphate T.S.

Sulphate.—Another 10-mil portion, acidulated with hydrochloric acid, is not rendered more than slightly turbid by barium chloride T.S.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Proceed as directed under the Assay for bromides (see U. S. P., Test No. 5, Chapter LXII), using about 0.4 Gm. of Sodium Bromide, dried to constant weight at 100° C. (212° F.) and accurately weighed. It shows, in the dried salt, not less than 98.5 per cent. of NaBr.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.010292 Gm. of NaBr. Each gramme of Sodium Bromide, previously dried, corresponds to not less than 95.7 mils nor more than 98.3 mils of tenth-normal silver nitrate V.S.

N. F. Preparations.—Elixir Sodii Bromidi; Elixir Trium Bromidorum; Syrupus Bromidorum.

Uses.—Sodium bromide is used for the same purposes as potassium bromide. It is probably inferior to the latter as a nerve sedative, although frequently combined with it. The dose is fifteen to sixty grains (1 to 4 Gm.).

SODII CACODYLAS. U. S. Sodium Cacodylate
[Sod. Cacodyl.]

Sodium dimethylarsenate [$Na(CH_3)_2AsO_2$=160.01], with a somewhat variable amount of water of crystallization. It contains not less than 72 per cent. nor more than 75 per cent. of $Na(CH_3)_2AsO_2$. Preserve it in well-closed containers.

Preparation.—Prepared by neutralizing cacodylic acid (dimethylarsenic acid) with sodium hydroxide, concentrating the solution and crystallizing. The acid is prepared by distilling arsenic trioxide with potassium acetate and oxidizing the distillate with mercuric oxide.

Official Description.—White, deliquescent prisms or a granular powder.

Odor, Taste, and Reaction.—Odorless. A solution of 2 Gm. of Sodium Cacodylate in 50 mils of distilled water requires not more than 0.5 mil of tenth-normal acid V.S. or tenth-normal alkali V.S. to render it neutral to phenolphthalein T.S.

Solubility.—One Gm. of Sodium Cacodylate dissolves in about 0.5 mil of water and in about 2.5 mils of alcohol at 25° C. (77° F.).

Tests for Identity.—It melts in its water of crystallization at about 60° C. (140° F.), and becomes anhydrous at 120° C. (248° F.). The salt burns with a bluish flame, emitting a garlic-like color.

The salt imparts an intensely yellow color to a non-luminous flame.

A mixture of a few drops of an aqueous solution of the salt (1 in 100) with 2 mils of hypophosphorous acid, allowed to stand in a stoppered tube, develops the odor of cacodyl within one hour.

Impurities and Tests for Impurities.—*Monomethyl Arsenate.*—No turbidity is produced in 10 mils of an aqueous solution of the salt (1 in 20) by 1 mil of calcium chloride T.S., either in the cold or on heating.

Arsenate or Phosphate.—No turbidity is produced in 5 mils of an aqueous solution of the salt (1 in 20) by 2 mils of magnesia mixture T.S. within one hour.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Chloride.—Separate portions of an aqueous solution of the salt (1 in 50), acidulated with nitric acid, are not rendered turbid at once by silver nitrate T.S.

Sulphate.—Or by barium chloride T.S.

Assay.—Dissolve about 2.5 Gm. of Sodium Cacodylate, acurately weighed, in distilled water, render the solution neutral to phenolphthalein T.S., if necessary, and then titrate with normal hydrochloric acid V.S., using methyl orange T.S. as indicator. It shows not less than 72 per cent. nor more than 75 per cent. of $Na(CH_3)_2AsO_2$.

Each mil of normal hydrochloric acid V.S. used corresponds to 0.1600 Gm. of $Na(CH_3)_2AsO_2$. Each gramme of Sodium Cacodylate corresponds to not less than 4.5 mils nor more than 4.7 mils of normal hydrochloric acid V.S.

Uses.—Similar in action to other arsenic compounds but claimed to be less likely to produce poisoning because of its slow absorption in the body. Used in anæmia and also in syphilis; usually administered hypodermically, in doses of one to three grains (0.065 to 0.2 Gm.).

SODII CARBONAS MONOHYDRATUS. U. S. Monohydrated Sodium Carbonate
[Sod. Carb. Monohyd.]

It contains not less than 99.5 per cent. of $Na_2CO_3+H_2O$ (124.02). Preserve it in well-closed containers.

Preparation.—Impure sodium carbonate, or soda-ash, is consumed in enormous quantities in the arts, and cheap methods of production have been long sought for. The process elaborated by Leblanc, a French apothecary, in 1784, has been most largely used, and it possesses an historic interest because of the public endorsements which it received from the French government in 1794. It is remarkable that this process has been successfully worked, without material modifications, *for a century*, and has supplied the world with cheap soap and cheap glass. It also furnishes a striking illustration of the unrequited labors of inventors and benefactors, from the fact that Leblanc died a pauper in a French asylum. Although the process has been superseded by other methods, it is worthy of study, and is as follows: sodium carbonate is made from common salt by two steps, first, by converting the salt by sulphuric acid into sodium sulphate, and, secondly, by decomposing the sulphate by calcium carbonate and charcoal at a high temperature, so as to yield sodium carbonate. The chemical reactions are as follows:

$$\underset{\substack{\text{Sodium}\\\text{Chloride}}}{2NaCl} + \underset{\substack{\text{Sulphuric}\\\text{Acid}}}{H_2SO_4} = \underset{\substack{\text{Sodium}\\\text{Sulphate}}}{NaSO_4} + \underset{\substack{\text{Hydrochloric}\\\text{Acid}}}{2HCl}$$

$$\underset{\substack{\text{Sodium}\\\text{Sulphate}}}{Na_2SO_4} + \underset{\substack{\text{Calcium}\\\text{Carbonate}}}{CaCO_3} + \underset{\text{Carbon}}{C_4} = \underset{\substack{\text{Sodium}\\\text{Carbonate}}}{Na_2CO_3} + \underset{\substack{\text{Calcium}\\\text{Sulphide}}}{CaS} + \underset{\substack{\text{Carbon}\\\text{Monoxide}}}{4CO}$$

The sulphate, first dried, is mixed with its own weight of ground limestone, and half its weight of small coal, ground and sifted, and the whole is heated in a reverberatory furnace, where it fuses and forms a black mass. The coal, at the temperature employed, converts the sodium sulphate into sodium sulphide. This reacts with the limestone, so as to form calcium sulphide and sodium carbonate. The black mass is next digested in warm water, which takes up the alkali and other soluble matters, and leaves the insoluble impurities, called *soda waste*, largely utilized in the manufacture of sodium thiosulphate. The solution is evaporated to dryness and the mass obtained is calcined with one-fourth of its weight of sawdust, to convert the alkali fully into carbonate, by means of the carbonic acid resulting from the combustion of the sawdust. The product is redissolved in water, and the solution evaporated to dryness. This soda-ash contains about 50 per cent. of sodium carbonate.

Solvay's process for making sodium bicarbonate is given on page 746; the bicarbonate is easily converted into carbonate by heating, and the carbon dioxide is utilized in another part of the process.

The cryolite process is used largely in the United States. Cryolite, $Al_2F_6 + 6NaF$, consists mainly of a double fluoride of aluminum and sodium, containing, in 100 parts, 13 of aluminum, 34 of sodium, and 53 of fluorine. Sodium carbonate is obtained by heating cryolite with chalk, whereby calcium fluoride is formed, while the sodium and aluminum combine to form sodium aluminate, a weak salt, which is dissolved out by lixiviation. The soda is converted into carbonate by passing carbon dioxide under pressure through the solution; and the alumina, separated from the soda, becomes insoluble, and is deposited.

$$\underset{\text{Cryolite}}{Al_2F_6 + 6NaF} + \underset{\substack{\text{Calcium}\\\text{Carbonate}}}{6CaCO_3} = \underset{\substack{\text{Sodium}\\\text{Aluminate}}}{Al_2O_3.3Na_2O} + \underset{\substack{\text{Calcium}\\\text{Fluoride}}}{6CaF_2} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{6CO_2}$$

Monohydrated sodium carbonate was first introduced into the U. S. P. VIII, because it is free from the excess of water of crystallization found in *sal soda* or ordinary sodium carbonate (63 per cent.); it is practically impossible to prevent efflorescence in this salt, and in making preparations inconvenience arises from the necessity of calculating the varying quantities of water present. The monohydrated carbonate is made by crystallizing a concentrated solution of sodium carbonate at a temperature above 35° C. (95° F.), and stirring the liquid so as to produce small crystals, washing, and purifying. It contains about 15 per cent. of water of crystallization and replaces the *exsiccated sodium carbonate* of earlier pharmacopœias.

Sodium carbonate is also prepared by the electrolysis of sodium chloride whereby sodium and chlorine are produced, the former reacting with water to produce sodium hydroxide and this solution treated with carbon dioxide to form sodium carbonate.

Official Description.—A white, crystalline, granular powder; when exposed to the air, under ordinary conditions, it absorbs only a slight percentage of moisture; exposed to warm, dry air at or above 50° C. (122° F.), the salt effloresces, and at 100° C. (212° F.), it becomes anhydrous.

Odor, Taste, and Reaction.—Odorless, and having a strongly alkaline taste. An aqueous solution of the salt (1 in 10) is strongly alkaline to litmus and phenolphthalein T.S., and effervesces with acids.

Solubility.—One Gm. of Monohydrated Sodium Carbonate dissolves in 3 mils of water, and in 7 mils of glycerin at 25° C. (77° F.); also in 1.8 mils of boiling water; insoluble in alcohol.

Tests for Identity.—An aqueous solution of the salt imparts an intensely yellow color to a non-luminous flame.

Impurities and Tests for Impurities.—*Heavy Metals.*—An aqueous solution of the salt (1 in 50), mixed with a slight excess of hydrochloric acid, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dissolve about 2.5 Gm. of Monohydrated Sodium Carbonate, accurately weighed, in about 25 mils of distilled water and titrate with normal sulphuric acid V.S., methyl orange T.S. being used as indicator. It shows not less than 99.5 per cent. of $Na_2CO_3+H_2O$.

Each mil of normal sulphuric acid V.S. used corresponds to 0.06201 Gm. of $Na_2CO_3+H_2O$. Each gramme of Monohydrated Sodium Carbonate corresponds to not less than 16.05 mils of normal sulphuric acid V.S.

U. S. P. Preparations.—Used in the process for making Alumini Hydroxidum; Liquor Sodæ Chlorinatæ; Massa Ferri Carbonatis; Suppositoria Glycerini.

N. F. Preparations.—Used in making Elixir Formatum; Elixir Formatum Compositum; Ferri Oxidum Saccharatum; Linimentum Saponato-Camphoratum; Liquor Alumini Acetico-Tartratis.

Uses.—Monohydrated sodium carbonate is one of the most useful of the alkaline salts; it is the source of most of the sodium salts made by the pharmacist. It is rarely given internally. The dose is from two to ten grains (0.13 to 0.65 Gm.).

SODII CHLORIDUM. U. S. Sodium Chloride
[Sod. Chlorid.]

It contains, when dried to constant weight at 110° C. (230° F.), not less than 99 per cent. of NaCl (58.46). Preserve it in well-closed containers.

Preparation.—Common salt is universally distributed over the world, and may be mined, as rock salt, or obtained by evaporating sea-water, and afterwards purifying. If perfectly free from contaminating salts, it will not become moist upon exposure to air.

Official Description.—Colorless, transparent, cubical crystals, or a white, crystalline powder; it is usually slightly hygroscopic.

Odor, Taste, and Reaction.—Odorless, and having a purely saline taste. An aqueous solution of the salt (1 in 10) is neutral to litmus.

Solubility.—One Gm. of Sodium Chloride dissolves in 2.8 mils of water, and in 10 mils of glycerin at 25° C. (77° F.); also in 2.7 mils of boiling water; slightly soluble in alcohol.

Tests for Identity.—When heated the salt decrepitates. At a red heat it fuses, and at a white heat it is slowly volatilized and partly decomposed. To a non-luminous flame it imparts an intensely yellow color.

With silver nitrate T.S. an aqueous solution of the salt (1 in 20) yields a white, curdy precipitate, insoluble in nitric acid, but readily soluble in ammonia water.

Impurities and Tests for Impurities.—*Heavy Metals.*—An aqueous solution of Sodium Chloride does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Calcium.—Separate portions of 10 mils each of an aqueous solution of Sodium Chloride (1 in 100), after the addition of 1 mil of ammonia water, show no immediate turbidity upon the addition of ammonium oxalate T.S.

Magnesium.—Or of sodium phosphate T.S.

Iodide or Bromide.—Digest 2 Gm. of the finely powdered salt for three hours with 25 mils of warm alcohol, cool the mixture and remove the undissolved salt by filtration. Evaporate the filtrate to dryness, dissolve the residue in 5 mils of distilled water, add 1 mil of chloroform, and cautiously introduce, drop by drop, with constant agitation, chlorine T.S. which has been diluted with twice its volume of distilled water. The chloroform does not acquire a violet, yellow, or orange color.

Assay.—Proceed as directed under the Assay for chlorides (see U. S. P., Test No. 5, Chapter LXII), using about 0.25 Gm. of Sodium Chloride, dried to constant weight at 110° C. (230° F.), and accurately weighed. It shows, in the dried salt, not less than 99 per cent. of $NaCl$.

Each mil of tenth-normal silver nitrate V.S. corresponds to 0.005846 Gm. of $NaCl$. Each gramme of Sodium Chloride, previously dried, corresponds to not less than 169.3 mils of tenth-normal silver nitrate V.S.

U. S. P. Preparation.—Liquor Sodii Chloridi Physiologicus.

N. F. Preparations.—Liquor Pancreatini; Lotio Ammoniacalis Camphorata; Sal Carolinum Factitium; Sal Carolinum Factitium Effervescens; Sal Kissingense Factitium; Sal Kissingense Factitium Effervescens; Sal Vichyanum Factitium; Sal Vichyanum Factitium Effervescens; Sal Vichyanum Factitium Effervescens cum Lithio.

Uses.—Sodium chloride is largely used as a condiment and an antiseptic. It undoubtedly serves a useful purpose in the animal economy, as many animals possess an instinctive craving for it. Salt baths are tonic, and valuable aids in many diseases. It is largely used in surgery in what is commonly called "normal salt solution" (see below). Common salt is used as a styptic in hemorrhage.

Average dose.—Four drachms (16 Gm.).

LIQUOR SODII CHLORIDI PHYSIOLOGICUS. U. S. Physiological Solution of Sodium Chloride

[**Liq. Sod. Chlor. Physio.**—Physiological Salt Solution Normal Salt Solution]

	Metric	Old form
Sodium Chloride..............................	**8.5 Gm.**	124 grains
Distilled Water, a sufficient quantity,		
To make..............................	**1000 mils**	**2 pints**

Dissolve the sodium chloride in sufficient freshly distilled water to measure 1000 mils [old form 2 pints] and filter. Then sterilize the solution, preferably in an autoclave, under steam pressure, at a temperature of from 115° to 120° C. (239° to 248° F.), for fifteen minutes, or by boiling it during at least one hour, and preserve it in a sterile condition. This solution should not be used after it has been made forty-eight hours.

This preparation must be made with great caution, observing the directions exactly, since it is frequently used for intravenous or subcutaneous injection and also in surgical operations and its sterility is important. The water must be freshly distilled, since distilled water, even after standing for a few days, is likely to be contaminated with microörganisms and, although these are destroyed by the process of sterilization, the toxins remain and cause disturbances when injected. A hard glass flask should also be used or the solution will contain soluble silicates which may separate in needle-like crystals on cooling.

SODII CITRAS. U. S. Sodium Citrate
[Sod. Cit.]

It contains not less than 98 per cent. of $Na_3C_6H_5O_7+2H_2O$ (294.07.) Preserve it in well-closed containers.

Preparation.—This salt is usually prepared by adding sodium carbonate to a solution of citric acid until effervescence ceases, evaporating and granulating the product.

Official Description.—It occurs in small crystals or as a white, granular powder.

Odor, Taste, and Reaction.—Odorless, and having a cooling, saline taste. An aqueous solution of Sodium Citrate (1 in 20) is slightly alkaline to litmus but is not reddened by 1 drop of phenolphthalein T.S.

Solubility.—One Gm. of Sodium Citrate dissolves in 1.3 mils of water at 25° C. (77°F.); also in 0.6 mil of boiling water; insoluble in alcohol.

Tests for Identity.—When heated to about 150° C. (302° F.), the salt loses all of its water of crystallization; on ignition at a red heat, it carbonizes and emits inflammable gases which have a very pungent, acrid odor, and a residue remains which is alkaline to litmus and strongly effervesces with acids.

To a non-luminous flame, the salt imparts an intensely yellow color.

Mix 10 mils of an aqueous solution of the salt (1 in 20) with 10 mils of calcium chloride T.S.; the liquid remains clear until it is boiled, when a white, granular precipitate is produced.

Impurities and Tests for Impurities.—*Heavy Metals.*—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of the salt meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Proceed as directed under the Assay for alkali salts of organic acids (see U. S. P., Test No. 6, Chapter LXII). It shows not less than 98 per cent. of $Na_3C_6H_5O_7+2H_2O$.

Each mil of half-normal sulphuric acid V.S. used corresponds to 0.04901 Gm. of $Na_3C_6H_5O_7+2H_2O$. Each gramme of Sodium Citrate corresponds to not less than 20 mils of half-normal sulphuric acid V.S.

N. F. Preparations.—Elixir Gentianæ; Liquor Ferri Albuminati; Liquor Ferri Peptonati; Liquor Ferri Peptonati et Mangani; Syrupus Hypophosphitum Compositus; Tinctura Ferri Citro-Chloridi.

Uses.—Sodium citrate is preferred to potassium citrate by some practitioners, and it is used in the process for making compound syrup of hypophosphites. The dose is four to fifteen grains (0.25 to 1 Gm.).

SODII CYANIDUM. U. S. Sodium Cyanide
[Sod. Cyanid.]

It contains not less than 95 per cent. of NaCN (49.01). Preserve it in well-closed containers, protected from light.

Note.—Sodium Cyanide replaces potassium cyanide of the U. S. P. VIII.

Preparation.—Several processes are in use to-day: By one process sodium carbonate is fused with calcium cyanide, the mixture treated with hot water and the solution crystallized. By the Castner process now extensively employed, dry ammonia gas is passed over metallic sodium at a temperature of 350° C. (662° F.), and the resulting product, then run through red hot charcoal, when sodium cyanide is formed. It may also be prepared by passing hydrocyanic acid gas into an alcoholic solution of sodium hydroxide, the sodium cyanide separating as a crystalline precipitate.

Official Description.—It occurs in white, opaque, amorphous pieces, or as a white, granular powder; deliquescent in the air and exhaling the odor of hydrocyanic acid. *Great caution must be used in handling this salt.*

Odor, Taste, and Reaction.—Odorless when perfectly dry. An aqueous solution of the salt (1 in 20) is strongly alkaline to litmus, and emits the odor of hydrocyanic acid.

Solubility.—It is freely soluble in cold water.

Tests for Identity.—At a low red heat the salt fuses. To a non-luminous flame it imparts an intensely yellow color.

A few drops of a solution of the salt (1 in 20) yield with silver nitrate T.S. a white precipitate, which is soluble in an excess of the solution of Sodium Cyanide, and in ammonia water.

Shake 5 mils of a solution of the salt (1 in 20) with a few drops each of ferrous sulphate T.S. and of ferric chloride T.S., and then add a slight excess of hydrochloric acid; a blue precipitate (iron ferrocyanide) is produced.

Impurities and Tests for Impurities.—*Ferrocyanide.*—In 5 mils of an aqueous solution of the salt (1 in 10) a drop of ferric chloride T.S. followed by 2 mils of diluted hydrochloric acid produces neither a dark blue color nor

Sulphocyanate.—A red color.

Assay.—Dissolve about 0.45 Gm. of Sodium Cyanide, accurately weighed, in 25 mils of distilled water, add 4 mils of ammonia water, 3 drops of potassium iodide T.S. and titrate with tenth-normal silver nitrate V.S. to the production of a permanent precipitate. It shows not less than 95 per cent. of NaCN.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.009802 Gm. of NaCN. Each gramme of Sodium Cyanide corresponds to not less than 96.9 mils of tenth-normal silver nitrate V.S.

Uses.—This salt has almost entirely replaced potassium cyanide in the American market, as it is less costly and may be used in smaller amounts to obtain the same cyanide value. This is owing to its smaller molecular weight, about seventy-five parts of the sodium salt being equivalent to 100 parts of potassium cyanide.

The action of this salt upon animals as a *poison* is the same as that of hydrocyanic acid. The dose is *one-tenth of a grain* (0.006 Gm.). It is more stable than the acid and is used as a substitute for it. In cases of poisoning by the cyanides, large quantities of ferrous sulphate in aqueous solution should be given at once, followed by an emetic or stomach pump and artificial respiration.

SODII GLYCEROPHOSPHAS. U. S. Sodium Glycerophosphate

[**Sod. Glycerophos.**—SODIUM GLYCERINOPHOSPHATE]

Hydrated Sodium Glycerophosphate containing not less than 68 per cent. of the anhydrous salt [$Na_2C_3H_7PO_6$ or $C_3H_5(OH)_2PO_4Na_2$ = 216.10].

Preparation.—This salt may be made by double decomposition between barium or calcium glycerophosphate and sodium carbonate or by neutralizing glycerophosphoric acid with sodium carbonate and concentrating the solution *in vacuo*. The *glycerophosphoric acid* is prepared by heating glycerin with phosphoric acid, at a temperature between 105° and 110° C. (221° to 230° F.). It is a clear, colorless, odorless liquid, of an acid taste, containing about 20 per cent. of the acid, $PO_3H_9O_6(C_3H_5(OH)_2OPO(OH)_2)$. Specific gravity 1.104.

Official Description.—White, monoclinic plates or scales, or a white powder.

Odor, Taste, and Reaction.—Having a saline taste; odorless. An aqueous solution of the salt (1 in 20) is alkaline to litmus and to phenolphthalein T.S.

Solubility.—It is very soluble in cold or hot water; nearly insoluble in alcohol.

Tests for Identity.—When strongly heated the salt is decomposed, evolving inflammable vapors, and at a red heat is converted into sodium pyrophosphate.

Impurities and Tests for Impurities.—*Free Alkali.*—Dissolve 1 Gm. of Sodium Glycerophosphate in 10 mils of distilled water and add 3 drops of phenolphthalein T.S.; the red color produced is discharged by the addition of 1.5 mils of tenth-normal sulphuric acid V.S.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Phosphates.—Add an equal volume of cold ammonium molybdate T.S. to 10 mils of an aqueous solution of the salt (1 in 20); no precipitate is formed within one hour. On heating this mixture a yellow precipitate is formed.

Alcohol-soluble Impurities.—Triturate 1 Gm. of the salt with 20 mils of dehydrated alcohol, filter the mixture, evaporate the filtrate on a water bath and dry the residue for one hour at a temperature not exceeding 70° C. (158° F.); the weight of this residue does not exceed 0.01 Gm.

Assay.—Dissolve about 3 Gm. of the salt, accurately weighed, in 30 mils of distilled water and titrate with half-normal hydrochloric acid V.S., using methyl orange T.S. as indicator. It shows not less than 68 per cent. of $Na_2C_3H_7PO_6$.

Each mil of half-normal hydrochloric acid V.S. used corresponds to 0.10805 Gm. of $Na_2C_3H_7PO_6$. Each gramme of Sodium Glycerophosphate corresponds to not less than 6.29 mils of half-normal hydrochloric acid V.S.

Uses.—It is employed, usually in combination with other glycerophosphates, in syrups or elixirs, in wasting or nervous diseases, as a "nerve tonic." The dose is usually four grains (0.25 Gm.).

LIQUOR SODII GLYCEROPHOSPHATIS. U. S. Solution of Sodium Glycerophosphate

[Liq. Sod. Glycerophos.—SOLUTION OF SODIUM GLYCERINOPHOSPHATE]

An aqueous solution of sodium glycerophosphate containing not less than 50 per cent. of the anhydrous salt ($Na_2C_3H_7PO_6$ or $Na_2C_3H_5(OH)_2PO_4 = 216.10$).

Official Description.—A clear, colorless or yellowish, syrupy liquid.

Odor, Taste, Reaction, and Tests for Identity and Impurities.—In other respects it conforms to the reactions and tests for purity under *Sodii Glycerophosphas.*

Assay.—Proceed as directed under *Sodii Glycerophosphas.* It shows not less than 50 per cent. of $Na_2C_3H_7PO_6$.

Each mil of half-normal hydrochloric acid V.S. used corresponds to 0.10805 Gm. of $Na_2C_3H_7PO_6$.

Each gramme of Solution of Sodium Glycerophosphate corresponds to not less than 4.63 mils of half-normal hydrochloric acid V.S.

N. F. Preparations.—Elixir Calcii et Sodii Glycerophosphatum: Elixir Glycerophosphatum Compositum.

Uses.—The same as sodium glycerophosphate in doses of six minims (0.35 mil).

SODII HYPOPHOSPHIS. U. S. Sodium Hypophosphite

[Sod. Hypophos.]

It contains not less than 98 per cent. of $NaPH_2O_2 + H_2O$ (106.07). Preserve it in well-closed containers. Caution should be observed in dispensing Sodium Hypophosphite, as an explosion is liable to occur when it is triturated or heated with nitrates, chlorates or other oxidizing agents.

Preparation.—This salt is prepared by mixing a solution of six ounces of calcium hypophosphite in four pints of water with a solution of ten ounces of sodium carbonate in one and a half pints of water.

$$\underset{\substack{\text{Calcium}\\\text{Hypophosphite}}}{Ca(H_2PO_2)_2} + \underset{\substack{\text{Sodium}\\\text{Carbonate}}}{Na_2CO_3} = \underset{\substack{\text{Sodium}\\\text{Hypophosphite}}}{2NaH_2PO_2} + \underset{\substack{\text{Calcium}\\\text{Carbonate}}}{CaCO_3}$$

Double decomposition takes place, with the formation of calcium carbonate and sodium hypophosphite, of which the latter is held in solution, and the former precipitated. After filtration to separate the calcium carbonate, the solution is evaporated until a pellicle forms, and then stirred constantly until the salt granulates, the heat being continued. If required quite pure, the granulated salt is dissolved in official alcohol, and the liquid, having been evaporated to a syrupy consistence, is set aside to crystallize.

Sometimes the sodium hypophosphite explodes with violence during the evaporation of its solution; this was ascribed to the fact that the solution was overheated; but the same accident has occurred when the heat was applied by means of a water bath. Evaporation, therefore, should be performed below 100° C. (212° F.).

$$\underset{\substack{\text{Sodium}\\ \text{Hypophosphite}}}{5NaH_2PO_2} = \underset{\substack{\text{Sodium}\\ \text{Pryophosphate}}}{Na_4P_2O_7} + \underset{\substack{\text{Sodium}\\ \text{Metaphosphate}}}{NaPO_3} + \underset{\substack{\text{Hydrogen}\\ \text{Phosphide}}}{2PH_3} + \underset{\text{Hydrogen}}{2H_2}$$

The gases evolved by heat are hydrogen and hydrogen phosphide. The latter is well known to be spontaneously inflammable.

The acid present in this salt is *hypophosphorous acid.* It consists of one atom of phosphorus, two atoms of oxygen, and three atoms of hydrogen, only one of the latter being replaceable by a metal. (See page 673.)

This acid is a powerful deoxidizer, and as it reduces mercury and silver from their combinations, it should not be prescribed with either.

Official Description.—Small, colorless, transparent, rectangular plates of a pearly luster, or a white, granular powder. It is deliquescent on exposure to moist air.

Odor, Taste, and Reaction.—Odorless, and having a saline taste. An aqueous solution of Sodium Hypophosphite (1 in 20) is neutral or slightly alkaline to litmus.

Solubility.—One Gm. of Sodium Hypophosphite dissolves in 1 mil of water at 25° C. (77° F.); also in about 0.15 mil of boiling water; soluble in alcohol, slightly soluble in dehydrated alcohol, and freely soluble in glycerin at 25° C. (77° F.); freely soluble in boiling alcohol.

Tests for Identity.—When heated in a test tube, the salt at first loses its water of crystallization, and upon further heating is decomposed, evolving spontaneously inflammable hydrogen phosphide, which burns with a bright yellow flame. To a non-luminous flame the salt imparts an intensely yellow color.

When an aqueous solution of the salt (1 in 20), acidulated with hydrochloric acid, is added drop by drop with agitation to an excess of mercuric chloride T.S., a white precipitate of mercurous chloride is formed. Upon the further addition of the solution of Sodium Hypophosphite, the precipitate becomes gray from reduction to metallic mercury.

Impurities and Tests for Impurities.—A solution of 1 Gm. of the salt in about 10 mils of distilled water requires not more than 1.5 mils of tenth-normal hydrochloric acid V.S. for neutralization, methyl orange T.S. being used as indicator.

Heat 5 mils of an aqueous solution of the salt (1 in 5) in a test tube with 0.5 mil of diluted hydrochloric acid on a water bath for thirty minutes; no offensive odor is developed.

Arsenic.—Measure 5 mils of an aqueous solution of the salt (1 in 25) into a beaker containing 3 mils of nitric acid, diluted with about 10 mils of distilled water, and evaporate the mixture to dryness on a water bath; the residue meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Phosphate.—Add magnesia mixture T.S. to 10 mils of an aqueous solution of the salt (1 in 20), made alkaline with ammonia water; it is not affected within one minute.

Assay.—Dissolve about 1 Gm. of Sodium Hypophosphite, accurately weighed, in 10 mils of distilled water, add 10 mils of nitric acid and evaporate the solution to dryness on a water bath. Then add 5 mils of nitric acid and again evaporate to dryness on a water bath. Dissolve the residue in 20 mils of distilled water, add a drop of phenolphthalein T.S. and sufficient special potassium hydroxide T.S. (see Reagents) to produce a pink color, and then dilute to exactly 100 mils with distilled water. Transfer 10 mils of this solution to a 100-mil graduated flask, add 50 mils of tenth-normal silver nitrate V.S. and proceed from this point as directed in the assay under *Sodii Phosphas.* It shows, in the dried salt, not less than 98 per cent. of $NaPH_2O_2+H_2O$.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.0035357 Gm. of $NaPH_2O_2+H_2O$. Each gramme of Sodium Hypophosphite corresponds to not less than 277.2 mils of tenth-normal silver nitrate V.S.

U. S. P. Preparation.—Syrupus Hypophosphitum.

N. F. Preparations.—Elixir Cinchonæ Alkaloidorum et Hypophosphitum; Elixir Hypophosphitum; Elixir Hypophosphitum et Ferri; Elixir Sodii Hypophosphitis; Emulsum Olei Morrhuæ cum Hypophosphitibus; Liquor Hypophosphitum; Liquor Hypophosphitum Compositus; Syrupus Calcii et Sodii Hypophosphitum; Syrupus Hypophosphitum Compositus; Syrupus Sodii Hypophosphitis.

Uses.—Sodium hypophosphite is used in phthisis and other wasting diseases, and in cases of defective nerve nutrition; pharmaceutically it is an ingredient in the various official and unofficial preparations of the hypophosphites; the dose is fifteen grains (1 Gm.).

SODII INDIGOTINDISULPHONAS. U. S. Sodium Indigotindisulphonate [Sod. Indigotin.—INDIGO CARMINE CÉRULÉINE]

Chiefly the sodium salt [$C_{16}H_8O_2N_2(SO_3Na)_2 = 466.22$] of indigotindisulphonic acid.

Preparation.—It may be made by adding a sodium salt to a solution of indigo sulphate, the latter being prepared by gradually adding powdered indigo to strong sulphuric acid, keeping the mixture cold during the reaction and washing and drying the precipitate.

Official Description.—A blue powder or a dark purple paste. When compressed, it acquires a coppery luster.

Before applying the following tests to the paste, deprive it of water by drying it to constant weight at 100° C. (212° F.).

Solubility.—Sodium Indigotindisulphonate is sparingly soluble in water, yielding a dark blue solution; almost insoluble in alcohol.

Tests for Identity.—The addition of nitric acid, bromine water, or chlorine water to an aqueous solution of the salt (1 in 200) discharges the blue color. The blue color is also discharged by warming this solution with sodium hydroxide and zinc dust or with stannous chloride T.S.

Dissolve 1 Gm. of Sodium Indigotindisulphonate, previously dried to constant weight at 100° C. (212° F.), in 200 mils of distilled water, filter the solution through counterbalanced filters, wash the filters and residue with distilled water until the washings cease to be colored blue, and dry at 100° C. (212° F.). The dry, insoluble residue remaining on the filter does not exceed 2 per cent.

Impurities and Tests for Impurities.—*Starch or Starch Iodide.*—Boil about 0.2 Gm. of Sodium Indigotindisulphonate for two minutes with 10 mils of distilled water, cool, and then triturate the solution with small portions of bromine water until the blue color disappears. On now adding a few drops of potassium iodide T.S. to the liquid, no blue color is produced.

Iron Ferricyanide or Ferrocyanide.—Add 15 mils of solution of hydrogen dioxide and 10 mils of sodium hydroxide T.S. to about 0.2 Gm. of the salt, shake the mixture until the blue color disappears, then evaporate the liquid to about 10 mils, cool, acidulate with hydrochloric acid, and add a few drops of ferrous sulphate T.S.; no blue color is produced.

U. S. P. Preparation.—Toxitabellæ Hydrargyri Chloridi Corrosivi.

Uses.—In the U. S. P. it is recommended as a blue coloring for "Bichloride Tablets," being preferable to other blue dyes because of its permanency. It is also used as a dye and for the volumetric estimation of nitrates and chlorine.

SODII IODIDUM. U. S. Sodium Iodide [Sod. Iod.]

It contains, when dried to constant weight at 100° C. (212° F.), not less than 99 per cent. of NaI (149.92). It contains not more than 7 per cent. of moisture. Preserve it in well-closed containers.

Preparation.—This iodide may be prepared by double decomposition between solutions of ferrous iodide and sodium carbonate, or by treating a solution of sodium hydroxide with iodine, exactly as in the preparation of potassium iodide. The former process is preferable if working on a small scale.

$$\underset{\substack{\text{Ferrous}\\ \text{Iodide}}}{FeI_2} + \underset{\substack{\text{Sodium}\\ \text{Carbonate}}}{Na_2CO_3} = \underset{\substack{\text{Sodium}\\ \text{Iodide}}}{2NaI} + \underset{\substack{\text{Ferrous}\\ \text{Carbonate}}}{FeCO_3}$$

By boiling the solution containing the ferrous carbonate, the latter is rendered less bulky, and it can be easily separated by filtration.

Official Description.—Colorless, cubical crystals, or a white, crystalline powder. In moist air Sodium Iodide deliquesces, or at first cakes and then deliquesces, and frequently undergoes decomposition, assuming a brown tint.

Odor, Taste, and Reaction.—Odorless, and having a saline taste. An aqueous solution of Sodium Iodide (1 in 20) is neutral or slightly alkaline to litmus.

Solubility.—One Gm. of Sodium Iodide dissolves in 0.55 mil of water, about 2 mils of alcohol, and in 1 mil of glycerin at 25° C. (77° F.); also in 0.4 mil of boiling water.

Tests for Identity.—When strongly heated, the salt melts, and at a bright red heat it is slowly volatilized and partly decomposed. To a non-luminous flame it imparts an intensely yellow color.

Add 1 mil of ferric chloride T.S., diluted with an equal volume of distilled water, to 5 mils of an aqueous solution of the salt (1 in 20), and shake the mixture with 5 mils of chloroform; the latter acquires a violet color.

Impurities and Tests for Impurities.—*Alkali.*—Dissolve 1 Gm. of the salt in 10 mils of distilled water, and add 0.15 mil of tenth-normal sulphuric acid V.S.; no red color is produced by the addition of a drop of phenolphthalein T.S.

Potassium.—A solution of 1 Gm. of the salt in 1 mil of distilled water yields no precipitate with 1 mil of sodium bitartrate T.S.

Iodate.—Dissolve 0.5 Gm. of the salt in 10 mils of distilled water, which has been previously boiled and cooled, and add 2 drops of diluted sulphuric acid (free from sulphurous or nitrous acid); no distinct, yellow color appears within half a minute and

Thiosulphate.—No turbidity occurs.

Nitrate or Nitrite.—Add five mils of potassium hydroxide T.S. and about 0.2 Gm. of aluminum wire to a solution of 1 Gm. of Sodium Iodide, in 5 mils of distilled water contained in a test tube of about 40 mils capacity. Insert a pledget of purified cotton in the upper portion of the test tube, and place a piece of moistened red litmus paper over its mouth. On heating the tube and contents upon a water bath for fifteen minutes, no blue coloration of the paper is discernible.

Barium.—Ten mils of an aqueous solution of the salt (1 in 20), acidulated with hydrochloric acid, is not rendered turbid by the addition of 1 mil of potassium sulphate T.S.

Sulphate.—Another 10-mil portion of an aqueous solution (1 in 20), acidulated with hydrochloric acid, is not rendered more than slightly turbid by a few drops of barium chloride T.S.

Cyanide.—Heat gently 5 mils of an aqueous solution of the salt (1 in 10) with 1 drop of ferrous sulphate T.S., 1 drop of ferric chloride T.S., and 0.5 mil of potassium hydroxide T.S.; no blue color appears after acidulating the mixture with hydrochloric acid.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Moisture.—When dried to constant weight at 100° C. (212° F.), it loses not more than 7 per cent. of its weight.

Assay.—Proceed as directed under the Assay for iodides (see U. S. P., Test No. 5, Chapter LXII), using about 0.5 Gm. of Sodium Iodide, previously dried to constant weight at 100° C. (212° F.) and accurately weighed. It shows, in the dried salt, not less than 99 per cent. of NaI.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.014992 Gm. of NaI. Each gramme of Sodium Iodide, previously dried, corresponds to not less than 66 mils nor more than 67.7 mils of tenth-normal silver nitrate V.S.

N. F. Preparation.—Syrupus Ferri et Mangani Iodidi.

Uses.—Medicinally, this salt is preferred to potassium iodide by some practitioners, although apparently without good reason. The *dose* is from five to fifteen grains (0.32 to 1 Gm.).

SODII NITRIS. U. S. Sodium Nitrite

[Sod. Nitris]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 95 per cent. of $NaNO_2$ (69.01). Preserve it in well-closed containers.

Preparation.—Sodium nitrite has been made official solely on account of its use in preparing spirit of nitrous ether. It is made by heating sodium nitrate in contact with starch, or preferably by adding strips of sheet lead to sodium nitrate heated to the fusing point for several hours, lead oxide being formed at the same time. After cooling, the fused sodium nitrite is lixiviated with water, purified, and recrystallized.

$$\underset{\text{Sodium Nitrate}}{NaNO_3} + \underset{\text{Lead}}{Pb} = \underset{\text{Sodium Nitrite}}{NaNO_2} + \underset{\text{Lead Oxide}}{PbO}$$

Official Description.—It occurs as white, or nearly white, opaque, fused masses, or sticks, as colorless, transparent, hexagonal crystals, or as a granular powder. When exposed to the air, the salt deliquesces and is gradually oxidized to sodium nitrate, and becomes unfit for use.

Odor, Taste, and Reaction.—Odorless, and having a mild, saline taste. An aqueous solution of Sodium Nitrite (1 in 10) is slightly alkaline to litmus.

Solubility.—One Gm. of Sodium Nitrite dissolves in 1.5 mils of water at 25° C. (77° F.); sparingly soluble in alcohol; very soluble in boiling water.

Tests for Identity.—When heated the salt melts, and at a red heat is decomposed, yielding oxygen, nitrogen, nitrogen dioxide, and sodium oxide. To a non-luminous flame it imparts an intensely yellow color.

Mix 5 mils of an aqueous solution of the salt (1 in 10) with 5 drops of potassium iodide T.S. and add 5 drops of hydrochloric acid; iodine is liberated, and nitrogen dioxide gas escapes with effervescence.

Impurities and Tests for Impurities.—*Heavy Metals.*—Dissolve 0.5 Gm. of the salt in 25 mils of diluted hydrochloric acid, evaporate the solution to dryness and dissolve the residue in 25 mils of distilled water, adding a few drops of diluted hydrochloric acid; 10 mils of the resulting solution does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dissolve about 1 Gm. of Sodium Nitrite, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed in a stoppered weighing-bottle, in sufficient distilled water to make 100 mils, and add 10 mils of this solution, from a pipette, to a solution consisting of 50 mils of tenth-normal potassium permanganate V.S., 100 mils of distilled water and 5 mils of sulphuric acid. In adding the sodium nitrite solution, immerse the tip of the pipette beneath the surface of the permanganate mixture. Warm the liquid to 40° C. (104° F.), allow it to stand for five minutes and then titrate with tenth-normal oxalic acid V.S. It shows, in the dried salt, not less than 95 per cent. of $NaNO_2$.

Each mil of tenth-normal potassium permanganate V.S. used corresponds to 0.0034505 Gm. of $NaNO_2$. Each gramme of Sodium Nitrite, previously dried, corresponds to not less than 275.3 mils of tenth-normal potassium permanganate V.S.

U. S. P. Preparation.—Spiritus Ætheris Nitrosi.

Uses.—This salt is used in making spirit of nitrous ether.

Average dose.—One grain (0.065 Gm.).

SODII PERBORAS. U. S. Sodium Perborate

[Sod. Perbor.]

It contains not less than 9 per cent. of available oxygen, corresponding to about 86.5 per cent. of $NaBO_3 + 4H_2O$ (154.06). Preserve it in well-closed containers, in a cool place.

Preparation.—It is made by mixing 248 parts of boric acid with 78 parts of sodium peroxide, pouring the mixture slowly into 2000 parts of cold water, acidified with sulphuric acid, and separating and drying the crystals at 50° C. (122° F.).

Official Description.—White, crystalline granules or a powder. Stable in cool and dry air, but decomposed with the evolution of oxygen in warm or moist air.

Odor, Taste, and Reaction.—Odorless, and having a saline taste. A saturated aqueous solution of the salt is alkaline to litmus or phenolphthalein. T.S.

Solubility.—Soluble in water. In aqueous solution is decomposed into metaborate and hydrogen dioxide, the solution gradually evolving oxygen. Oxygen is evolved more rapidly if the solution is warmed.

Tests for Identity.—The salt imparts an intensely yellow color to a non-luminous flame. Turmeric paper, if moistened with an aqueous solution of the salt which has been acidulated with hydrochloric acid, becomes brown in color, particularly on drying; on moistening the dried test paper with ammonia water, the color is changed to greenish-black.

Agitate a mixture of 1 mil of an aqueous solution of the salt (1 in 50), 1 mil of diluted sulphuric acid, a few drops of potassium dichromate T.S., and 2 mils of ether; the ether acquires a blue color.

Impurities and Tests for Impurities.—*Heavy Metals.*—Strongly heat 0.5 Gm. of the salt in a platinum crucible, and dissolve the residue in 25 mils of distilled water with the aid of a few drops of hydrochloric acid; 10 mils of the resulting solution does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dissolve about 0.25 Gm. of the salt, accurately weighed, in a mixture of 50 mils of distilled water and 10 mils of diluted sulphuric acid and titrate the solution with tenth-normal potassium permanganate V.S. It shows not less than 9 per cent. of available oxygen.

Each mil of tenth-normal potassium permanganate V.S. used corresponds to 0.0008 Gm. of available oxygen. Each gramme of Sodium Perborate corresponds to not less than 112.5 mils of tenth-normal potassium permanganate V.S.

Uses.—It is used as an antiseptic dusting powder or as a wash in aqueous solution for wounds and ulcers, also used in toilet preparations as an antiseptic and bleaching agent. Its activity depends upon the liberation of oxygen when in contact with animal matter or animal ferments. The dose is one grain (0.065 Gm.).

SODII PHENOLSULPHONAS. U. S. **Sodium Phenolsulphonate**
[**Sod. Phenolsulph.**—SODIUM SULPHOCARBOLATE]

It contains not less than 83.64 per cent. nor more than 87.82 per cent. of anhydrous sodium phenolsulphonate (sodium paraphenolsulphonate), corresponding to not less than 99 per cent. of the crystallized salt [$NaC_6H_5O.SO_3 + 2H_2O = 232.14$]. Preserve it in well-closed containers.

Preparation.—Sodium phenolsulphonate may be made by mixing equal parts of pure phenol and strong sulphuric acid, whereby *phenolsulphonic acid*, $C_6H_5HSO_4$, is produced. The mixed liquids must be subjected to a temperature of 55° C. (131° F.) for several days, to convert this into *paraphenolsulphonic acid*, and then twenty parts of water should be added. Two parts of barium carbonate are mixed with the liquid, a little at a time, carefully graduating the quantity until effervescence ceases. The liquid is now allowed to stand, to permit the precipitation of the barium sulphate, and of any carbonate which may be present, and the liquid filtered. The solution of *barium paraphenolsulphonate* is decomposed by adding sodium carbonate until precipitation ceases, when the liquid is filtered from the barium carbonate, and the sodium paraphenolsulphonate may be obtained by evaporating the filtrate and crystallizing.

$$\underset{\text{Phenol}}{C_6H_5OH} + \underset{\substack{\text{Sulphuric}\\\text{Acid}}}{H_2SO_4} = \underset{\substack{\text{Phenolsulphonic}\\\text{Acid}}}{HC_6H_5SO_4} + \underset{\text{Water}}{H_2O}$$

Official Description.—Colorless, transparent, rhombic prisms or crystalline granules. It is somewhat efflorescent in dry air.

Odor, Taste, and Reaction.—Odorless, and having a cooling, saline, bitter taste. An aqueous solution of Sodium Phenolsulphonate (1 in 10) is neutral to litmus.

Solubility.—One Gm. of Sodium Phenolsulphonate dissolves in 4.2 mils of water, 140 mils of alcohol and in about 5 mils of glycerin at 25° C. (77° F.); also in 0.8 mil of boiling water and 13.5 mils of boiling alcohol.

Tests for Identity.—When heated slightly above 100° C. (212° F.), the salt loses all of its water of crystallization and becomes white. At a higher temperature it chars, emits inflammable vapors having the odor of phenol, and finally leaves a residue consisting chiefly of sodium sulphate. To a non-luminous flame it imparts an intensely yellow color.

A diluted solution of the salt (1 in 100) is rendered pale violet by ferric chloride T.S., but remains clear; barium chloride T.S. leaves the solution of the original salt clear, but if the salt is ignited, and the residue dissolved in distilled water, the same reagent produces in the filtered solution a copious, white precipitate.

Impurities and Tests for Impurities.—*Phenol.*—Add bromine T.S. to 10 mils of an aqueous solution of the salt (1 in 100); a permanent yellow color but neither turbidity nor precipitation is produced within two minutes.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dissolve about 0.25 Gm. of Sodium Phenolsulphonate, accurately weighed, in 50 mils of distilled water, add 50 mils of tenth-normal bromine V.S. and 5 mils of hydrochloric acid. Allow the mixture to stand for fifteen minutes, then add 2 Gm. of potassium iodide dissolved in 5 mils of distilled water, and subject the solution to residual titration with tenth-normal sodium thiosulphate V.S., using starch T.S. as indicator. It shows not less than 83.64 per cent. nor more than 87.82 per cent. of $NaC_6H_5O_4S$.

Each mil of tenth-normal bromine V.S. used corresponds to 0.04903 Gm. of $NaC_6H_5O_4S$. Each gramme of Sodium Phenolsulphonate corresponds to not less than 170.6 mils nor more than 179.1 mils of tenth-normal bromine V.S.

Uses.—This salt is used as an antiferment, in doses of four to twenty grains (0.25 to 1.3 Gm.), often given in enteric capsules so that its activity may be exerted in the intestinal tract. It is also used in injections.

SODII PHOSPHAS. U. S. Sodium Phosphate
[Sod. Phos.]

It contains not less than 39.25 per cent. nor more than 44.00 per cent. of anhydrous sodium phosphate (di-sodium-ortho-phosphate), corresponding to not less than 99 per cent. of the crystallized salt [$Na_2HPO_4+12H_2O=358.24$]. Preserve it in well-closed containers, in a cool place.

Preparation.—The part of bones which is incombustible is obtained by burning them to whiteness, and consists of neutral calcium phosphate called *bone-phosphate* or *bone-ash*, associated with some calcium carbonate. When this is mixed with sulphuric acid, the calcium carbonate is entirely decomposed, giving rise to effervescence. The calcium phosphate undergoes partial decomposition; the greater part of the lime, being liberated, precipitates as calcium sulphate, while the phosphoric acid combines with the undecomposed portion of the phosphate, and remains in solution as an acid calcium phosphate, holding a small portion of calcium sulphate in solution.

$$\underset{\substack{\text{Calcium}\\\text{Phosphate}}}{Ca_3(PO_4)_2} + \underset{\substack{\text{Sulphuric}\\\text{Acid}}}{2H_2SO_4} = \underset{\substack{\text{Acid Calcium}\\\text{Phosphate}}}{CaH_4(PO_4)_2} + \underset{\substack{\text{Calcium}\\\text{Sulphate}}}{2CaSO_4}$$

In order to separate the acid phosphate from the precipitated mass of calcium sulphate, boiling water is added to the mixture, the whole is strained, and the sulphate washed as long as acid phosphate is removed, which is known by the water which passes through having an acid reaction. The different liquids which have passed the strainer, consisting of the solution of acid calcium phosphate, are mixed and allowed to stand; by cooling, a portion of calcium sulphate is deposited, which is removed by decantation. The bulk of the liquid is now reduced by evaporation, and, in consequence of the diminution of the water, a fresh portion of calcium sulphate is deposited, which is separated by subsidence and decantation as before. The acid calcium phosphate solution, being heated, is now saturated by means of a hot solution of sodium carbonate. The carbonic acid is liberated with effervescence, and the alkali, combining with the excess of acid of the acid phosphate, produces sodium phosphate, while the acid calcium phosphate, by the loss of its excess of acid, becomes the neutral phosphate and precipitates.

$$\underset{\substack{\text{Acid Calcium}\\\text{Phosphate}}}{CaH_4(PO_4)_2} + \underset{\substack{\text{Sodium}\\\text{Carbonate}}}{Na_2CO_3} = \underset{\substack{\text{Calcium}\\\text{Phosphate}}}{CaHPO_4} + \underset{\substack{\text{Sodium}\\\text{Phosphate}}}{Na_2HPO_4} + \underset{\text{Water}}{H_2O} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{CO_2}$$

The calcium phosphate is separated by filtration; and the filtered liquid, which is a solution of sodium phosphate, is evaporated so as to crystallize.

Official Description.—Large, colorless, monoclinic prisms, or a granular, crystalline salt. The crystals effloresce in the air.

Odor, Taste, and Reaction.—Odorless, and having a cooling, saline taste. An aqueous solution of Sodium Phosphate (1 in 10) is alkaline to litmus and phenolphthalein T.S.

Solubility.—One Gm. of Sodium Phosphate dissolves in 2.7 mils of water at 25° C. (77° F.); insoluble in alcohol.

Tests for Identity.—When heated to about 40° C. (104° F.), the salt fuses, yielding a colorless liquid; at 100° C. (212° F.) it loses all of its water of crystallization and at a red heat is converted into sodium pyrophosphate. It imparts an intensely yellow color to a non-luminous flame.

An aqueous solution of the salt (1 in 20) yields a white, crystalline precipitate with magnesia mixture T.S.

Impurities and Tests for Impurities.—*Calcium or Aluminum.*—Not more than a slight turbidity appears on dissolving 1 Gm. of the salt in 20 mils of distilled water.

Carbonate.—No effervescence occurs on the addition of hydrochloric or nitric acid to a solution of the salt.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of the salt meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Chloride.—Add a few drops of silver nitrate T.S. to 10 mils of an aqueous solution of the salt (1 in 20), previously mixed with 5 mils of diluted nitric acid; not more than an opalescence is produced.

Assay.—Introduce about 0.4 Gm. of Sodium Phosphate, accurately weighed, into a 100-mil graduated flask, dissolve it in 10 mils of distilled water, add 50 mils of tenth-normal silver nitrate V.S. and agitate the mixture well. Then gradually add zinc oxide (see Reagents, Chapter LXII) in small portions until the liquid is neutral to litmus. Then add distilled water to make 100 mils, agitate the mixture thoroughly, filter through a dry filter, rejecting the first 20 mils of filtrate, collect 50 mils of the subsequent filtrate, add 2 mils of nitric acid and 2 mils of ferric ammonium sulphate T.S., and titrate with tenth-normal potassium sulphocyanate V.S. to the production of a permanent red color. It shows not less than 39.25 per cent. nor more than 44 per cent. of Na_2HPO_4.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.004735 Gm. of Na_2HPO_4. Each gramme of Sodium Phosphate corresponds to not less than 82.9 mils nor more than 92.9 mils of tenth-normal silver nitrate V.S.

U. S. Preparation.—Sodii Phosphas Exsiccatus.

N. F. Preparation.—Liquor Sodii Phosphatis Compositus.

Uses.—Sodium phosphate is principally used as a cathartic; it should be free from arsenic, and when purified it may be given in doses of one drachm to half an ounce (4 to 16 Gm.).

SODII PHOSPHAS EFFERVESCENS. U. S. Effervescent Sodium Phosphate

[Sod. Phos. Eff.]

	Metric	Old form
***Exsiccated Sodium Phosphate,** in fine powder	200 Gm.	4 oz. av.
Sodium Bicarbonate, dried and powdered	477 Gm.	9½ oz. av.
Tartaric Acid, dried and powdered	252 Gm.	5 oz. av.
Citric Acid, uneffloresced crystals	162 Gm.	3¼ oz. av.
To make about	1000 Gm.	20 oz. av.

Powder the citric acid and mix it intimately with the exsiccated sodium phosphate and tartaric acid, then thoroughly incorporate the sodium bicarbonate.

Place the mixed powders on a plate of glass or in a suitable dish, in an oven heated to between 93° and 104° C. (199.4° to 219.2° F.). Manipulate the mixture carefully with a wooden spatula, and, when it has become moist, rub it through a No. 6 tinned-iron sieve, and dry the granules at a temperature not exceeding 54° C. (129.2° F.). Immediately transfer the salt to suitable containers and seal them tightly. Care must be taken to prevent the salt from coming in contact with air containing moisture.

Uses.—Effervescent Sodium Phosphate furnishes a pleasant means of administering sodium phosphate. Dose, two and one-half drachms (10 Gm.).

SODII PHOSPHAS EXSICCATUS. U. S. Exsiccated Sodium Phosphate

[Sod. Phos. Exsic.]

It contains, when dried to constant weight at 110° C. (230° F.), not less than 98 per cent. of Na_2HPO_4 (142.05). Preserve it in well-closed containers.

***Sodium Phosphate,** *a convenient quantity.*

Allow the crystals to effloresce for several days in warm air, at a temperature of from 25° to 30° C. (77° to 86° F.), then continue the drying in an oven, raising the temperature very gradually until 100°C. (212° F.) has been reached, and maintaining this temperature until the salt ceases to lose weight. Powder and sift the residue and transfer it to well-closed containers.

Official Description.—A white powder which absorbs moisture readily.

Odor, Taste, Reaction, Identity and Impurities.—After allowance is made for the loss of water of crystallization, it conforms to the reactions and tests under *Sodii Phosphas.*

Solubility.—One Gm. of Exsiccated Sodium Phosphate dissolves in 8.1 mils of water at 25° C. (77° F.); also in 1.1 mils of boiling water; insoluble in alcohol.

Assay.—Exsiccated Sodium Phosphate, when quantitatively estimated by the assay method under *Sodii Phosphas*, using about 0.15 Gm. of the salt, previously dried to constant weight at 110° C. (230° F.), and accurately weighed, shows, in the dried salt, not less than 98 per cent. of Na_2HPO_4.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.004735 Gm. of Na_2HPO_4. Each gramme of Exsiccated Sodium Phosphate, previously dried, corresponds to not less than 207 mils of tenth-normal silver nitrate V.S.

U. S. Preparation.—Sodii Phosphas Effervescens.

Uses.—This salt is used in making effervescent sodium phosphate. It may be given in doses of from fifteen to thirty grains (1 to 2 Gm.).

SODII SALICYLAS. U. S. Sodium Salicylate
[Sod. Salicyl.]

It contains, when dried to constant weight at 100° C. (212° F.), not less than 99.5 per cent. of $NaC_7H_5O_3$ (160.04). Preserve it in well-closed containers, protected from heat and light.

Preparation.—Sodium salicylate is prepared by mixing one hundred parts of pure salicylic acid with sufficient distilled water to form a paste, and then with one hundred and four parts of pure crystallized sodium carbonate (uneffloresced) in a glass or porcelain vessel; carbon dioxide will be evolved, and sodium salicylate will remain in solution.

$$\underset{\text{Salicylic Acid}}{2HC_7H_5O_3} + \underset{\substack{\text{Sodium}\\\text{Carbonate}}}{Na_2CO_3} = \underset{\substack{\text{Sodium}\\\text{Salicylate}}}{2NaC_7H_5O_3} + \underset{\text{Water}}{H_2O} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{CO_2}$$

The liquid may be strained through thoroughly washed muslin if necessary, and heated in a porcelain dish until the carbon dioxide is expelled.

It should not be filtered through ordinary paper, on account of the impurities generally present in paper; the slightest contact with iron will discolor the product, and for this reason the commercial sodium carbonate is unfitted for use in making this salt.

If alkaline to litmus paper, enough salicylic acid must be added to be slightly in excess, and the solution should be evaporated at a low heat to dryness. If the acid is not in excess, the salt will not be white, but gray or lead-colored; and if heated too much, the odor of phenol will be noticed.

Official Description.—It occurs as a white, micro-crystalline powder, or in scales, or as an amorphous powder; colorless or having not more than a faint pink tinge.

Odor, Taste, and Reaction.—Odorless, or having a faint, characteristic odor and a sweet, saline taste. An aqueous solution of Sodium Salicylate (1 in 10) when freshly made is colorless or nearly colorless, and neutral or slightly acid to litmus.

Solubility.—One Gm. of Sodium Salicylate dissolves in 0.9 mil of water and in 9.2 mils of alcohol at 25° C. (77° F.); very soluble in boiling water or in boiling alcohol; soluble in glycerin.

Tests for Identity.—When heated the salt is decomposed, giving off inflammable vapors and an odor of phenol, and finally leaving a residue of sodium carbonate and carbon. To a non-luminous flame it imparts an intensely yellow color.

Add a few drops of ferric chloride T.S. to an excess of a concentrated aqueous solution of Sodium Salicylate (1 in 4); a dark red color and a precipitate are produced. In a solution of the salt (1 in 100) a deep violet-blue color is produced.

Diluted hydrochloric acid or sulphuric acid produces a voluminous, white precipitate in a concentrated aqueous solution of the salt.

Impurities and Tests for Impurities.—*Sulphite or Thiosulphate.*—Add 1 mil of hydrochloric acid to a solution of 1 Gm. of Sodium Salicylate in 20 mils of distilled water and filter the liquid; the filtrate does not decolorize 2 drops of tenth-normal iodine V.S.

Heavy Metals.—Add a slight excess of hydrochloric acid to an aqueous solution of the salt (1 in 50), and filter; the filtrate does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Proceed as directed under the Assay for alkali salts of organic acids (see U. S. P., Test No. 6, Chapter LXII), using about 2 Gm. of Sodium Salicylate, previously dried to constant weight at 100° C. (212° F.) and accurately weighed. It shows, in the dried salt, not less than 99.5 per cent. of $NaC_7H_5O_3$.

Each mil of half-normal sulphuric acid V.S. used corresponds to 0.08002 Gm. of $NaC_7H_5O_3$. Each gramme of Sodium Salicylate, previously dried, corresponds to not less than 12.43 mils of half-normal sulphuric acid V.S.

N. F. Preparation.—Caffeinæ Sodio-salicylas; Elixir Sodii Salicylatis; Elixir Sodii Salicylatis Compositum; Liquor Antisepticus; Liquor Ferri Salicylatis.

Uses.—This salt is administered in rheumatic and neuralgic affections, in doses of fifteen to thirty grains (1 to 2 Gm.).

SODII SULPHAS. U. S. Sodium Sulphate

[Sod. Sulph.—Glauber's Salt]

It contains not less than 43.64 per cent. nor more than 48 per cent. of anhydrous sodium sulphate, corresponding to not less than 99 per cent. of the crystallized salt [$Na_2SO_4+10H_2O=322.23$]. Preserve it in well-closed containers, in a cool place.

Preparation.—This salt is largely obtained as a by-product in the manufacture of soda-ash, hydrochloric and nitric acids, ammonium chloride, etc.

Official Description.—It occurs as large, colorless, transparent, monoclinic prisms, or granular crystals.

Odor, Taste, and Reaction.—Odorless, having a bitter, saline taste. An aqueous solution of the salt (1 in 10) is neutral to litmus. The salt effloresces rapidly in the air.

Solubility.—One Gm. of Sodium Sulphate dissolves in slightly over 1 mil of water at 25° C. (77° F.); insoluble in alcohol; soluble in glycerin; when heated to about 33° C. (91.4° F.) it melts in its water of crystallization.

Tests for Identity.—When gently heated the salt fuses, and, on continuing the heat to 100° C. (212° F.), it loses all of its water of crystallization (about 56 per cent.). At a red heat, the anhydrous salt fuses without decomposition. To a non-luminous flame it imparts an intensely yellow color.

An aqueous solution of Sodium Sulphate (1 in 20) yields with barium chloride T.S. a white precipitate insoluble in hydrochloric acid.

Impurities and Tests for Impurities.—*Arsenic.*—An aqueous solution of the salt meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dissolve about 1 Gm. of Sodium Sulphate, accurately weighed, in 100 mils of distilled water, acidulate the solution with hydrochloric acid and heat it to boiling. Gradually add an excess of hot barium chloride T.S., heat for thirty minutes on a water bath, collect the precipitate of barium sulphate on a filter, wash it until silver nitrate T.S. no longer produces an opalescence in 2 mils of the filtrate acidulated with nitric acid, dry, ignite, and weigh it. It corresponds to not less than 43.64 per cent. nor more than 48 per cent. of Na_2SO_4.

Each gramme of Sodium Sulphate corresponds to not less than 0.717 Gm. nor more than 0.789 Gm. of $BaSO_4$.

N. F. Preparation.—Sal Carolinum Factitium; Sal Carolinum Factitium Effervescens.

In using the formulas requiring this salt, care must be employed to see that it is not effloresced, as such a salt will have lost most of its water of crystallization and therefore be correspondingly stronger than the crystalline salt.

Uses.—This well-known sulphate is largely used in veterinary practice. As a purgative it is not so well suited for administration to human beings, the magnesium sulphate being preferred. It may be given to adults in doses of half an ounce to one ounce (16 to 31 Gm.).

SODII SULPHIS EXSICCATUS. U. S. Exsiccated Sodium Sulphite

[Sod. Sulphis Exsic.]

It contains not less than 90 per cent. of Na_2SO_3 (126.07). Preserve it in well-closed containers, in a cool place.

Preparation.—A very satisfactory mode of making this sulphite is by dissolving a convenient weight of sodium carbonate in a small quantity of water, then passing sulphurous acid gas through the solution until it is completely saturated and acid sodium sulphite is formed. The addition of an equal weight of sodium carbonate forms a solution of the neutral sulphite, which is to be evaporated and crystallized.

$$\underset{\substack{\text{Sodium}\\\text{Carbonate}}}{Na_2CO_3} + \underset{\substack{\text{Sulphur}\\\text{Dioxide}}}{SO_2} = \underset{\substack{\text{Sodium}\\\text{Sulphite}}}{Na_2SO_3} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{CO_2}$$

The sodium sulphite which is most frequently used now is the *granulated sodium sulphite*: this is prepared by evaporating a solution of the sulphite to dryness in the usual manner. As thus prepared, it is much more stable than the crystallized salt; it should be remembered, however, that it is of nearly twice the strength of the latter, and the quantity used should be proportionately lessened. Theoretically, the quantity of water present in the crystals is exactly half their weight.

Official Description.—A white powder. Exposed to the air, it is slowly oxidized to sulphate.

Odor, Taste, and Reaction.—Odorless, and having a cooling, saline, sulphurous taste. An aqueous solution of the salt (1 in 10) is alkaline to litmus.

Solubility.—One Gm. of Sodium Sulphite dissolves in 3.2 mils of water at 25° C. (77° F.); sparingly soluble in alcohol.

Tests for Identity.—At a red heat, the salt fuses to a reddish-yellow mass of sodium sulphate and sodium sulphide. To a non-luminous flame the salt imparts an intensely yellow color.

Upon the addition of hydrochloric acid to the salt, sulphur dioxide is liberated, which is recognized by its odor, and by its blackening a strip of paper moistened with mercurous nitrate T.S. held in the escaping gas.

Impurities and Tests for Impurities.—*Thiosulphate.*—Dissolve 1 Gm. of Exsiccated Sodium Sulphite in 10 mils of diluted hydrochloric acid and heat the solution sufficiently to expel the gases; the liquid does not become turbid.

Heavy Metals.—Dissolve 1 Gm. of the salt in 20 mils of diluted hydrochloric acid, evaporate the solution to dryness, and dissolve the residue in 50 mils of distilled water. Ten mils of this solution does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Add 3 mils of nitric acid to 5 mils of an aqueous solution of the salt (1 in 25), cautiously evaporate the solution to dryness on a water bath, and treat the residue with a few mils of distilled water and filter the liquid. On evaporating the filtrate and washings to dryness, this residue meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Add about 0.3 Gm. of Exsiccated Sodium Sulphite, accurately weighed, to 50 mils of tenth-normal iodine V.S. in a glass-stoppered flask, agitate the mixture until complete solution results and titrate with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator. It shows not less than 90 per cent. of Na_2SO_3.

Each mil of tenth-normal iodine V.S. used corresponds to 0.006304 Gm. of Na_2SO_3. Each gramme of Exsiccated Sodium Sulphite corresponds to not less than 142.8 mils of tenth-normal iodine V.S.

Uses.—Exsiccated sodium sulphite is one of the most useful antiferments. It is given in doses of ten to thirty grains (0.65 to 2 Gm.).

SODII THIOSULPHAS. U. S. Sodium Thiosulphate

[Sod. Thiosulph.—"SODIUM HYPOSULPHITE"]

It contains not less than 63.07 per cent. nor more than 67.48 per cent. of anhydrous sodium thiosulphate, corresponding to not less than 99 per cent. of the crystallized salt [$Na_2S_2O_3+5H_2O=248.22$]. Preserve it in well-closed containers.

Preparation.—Sodium thiosulphate, official in the U. S. P. 1890 as *sodium hyposulphite,* is made by decomposing soluble calcium thiosulphate, obtained by the oxidation of alkali waste, with either sodium sulphate or sodium carbonate.

$$\underset{\text{Calcium Thiosulphate}}{CaS_2O_3} + \underset{\text{Sodium Sulphate}}{Na_2SO_4} = \underset{\text{Sodium Thiosulphate}}{Na_2S_2O_3} + \underset{\text{Calcium Sulphate}}{CaSO_4}$$

Other methods of making "hyposulphite of soda" have been used, but the above process has superseded them because of its economy. It is now made on a very large scale.

Official Description.—It occurs as colorless, transparent, monoclinic prisms. It is permanent in the air below 33° C. (91.4° F.), but efflorescent in dry air above that temperature; slightly deliquescent in moist air.

Odor, Taste, and Reaction.—Odorless, and having a cooling, afterwards bitter taste. An aqueous solution of the salt (1 in 10) is neutral or faintly alkaline to litmus.

Solubility.—One Gm. of Sodium Thiosulphate dissolves in 0.5 mil of water at 25° C. (77° F.); insoluble in alcohol; at boiling temperatures it is rapidly decomposed.

Tests for Identity.—When rapidly heated the salt melts. When heated slowly until it is effloresced, and afterwards to 100° C. (212° F.), it undergoes partial decomposition, loses all of its water of crystallization, and at red heat is decomposed, sulphur being liberated, while a residue of sodium sulphide and sodium sulphate remains. To a non-luminous flame it imparts an intensely yellow color.

An aqueous solution of Sodium Thiosulphate readily dissolves many compounds of silver (chloride, bromide, iodide, oxide, etc.) and discharges the color of a solution of iodine or of starch iodide.

Add a few drops of ferric chloride T.S. to 5 mils of an aqueous solution of the salt (1 in 10); a dark violet color is produced which disappears rapidly upon agitation.

Impurities and Tests for Impurities.—Distinction from *sulphite or bisulphite.*—The addition of sulphuric or hydrochloric acid to an aqueous solution of Sodium Thiosulphate liberates sulphur dioxide (recognized by its odor, and by its blackening a strip of paper moistened with mercurous nitrate T.S. held in the escaping gas); a white precipitate of sulphur is also formed.

Calcium.—An aqueous solution of the salt (1 in 20) is not rendered turbid by the addition of ammonium oxalate T.S.

Heavy Metals.—Add 10 mils of diluted hydrochloric acid to 1 Gm. of the salt, evaporate it to dryness on a water bath, heat the residue with 50 mils of distilled water and filter. Ten mils of this filtrate does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Add 3 mils of nitric acid to 5 mils of an aqueous solution of the salt (1 in 25), evaporate the solution cautiously to dryness on a water bath, treat the residue with a few mils of distilled water, filter the liquid and evaporate the filtrate and washings to dryness; the residue meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Dissolve about 1 Gm. of Sodium Thiosulphate, accurately weighed, in about 20 mils of distilled water and titrate with tenth-normal iodine V.S., starch T.S. being used as indicator. It shows not less than 63.07 per cent. nor more than 67.48 per cent. of $Na_2S_2O_3$.

Each mil of tenth-normal iodine V.S. used corresponds to 0.015814 Gm. of $Na_2S_2O_3$. Each gramme of Sodium Thiosulphate corresponds to not less than 39.9 mils nor more than 42.7 mils of tenth-normal iodine V.S.

N. F. Preparations.—Tinctura Iodi Decolorata; Unguentum Potassii Iodidi.

Uses.—This compound is used in the official volumetric test solution of sodium thiosulphate, and occasionally in medicine, as an alterative and resolvent, in doses of ten to thirty grains (0.65 to 2 Gm.). Externally, it is used in baths and also as an ointment, and its saturated, aqueous solution is used in the treatment of "ivy poisoning." Its principal use is in the arts, as an *antichlor* in paper manufacture; while in photography, under the abbreviated name of "*hypo,*" it is invaluable as a solvent for the unaltered silver chloride or bromide in the film.

SODA CUM CALCE. N. F. Soda with Lime
[Sod. c. Calc.—LONDON PASTE]

	Metric	Old form
Sodium Hydroxide, **Calcium Oxide, each**	**50 Gm.**	**2 ozs. av.**
To make	**100 Gm.**	**4 ozs. av.**

Reduce the sodium hydroxide and calcium oxide, separately, to a powder in a clean iron mortar, previously warmed, and then mix them intimately. Keep the powder in small, well-closed containers.

Uses.—This is used as a caustic, the powder being mixed with water to form a paste, just before applying.

SODII BORO-BENZOAS. N. F. Sodium Boro-Benzoate

[Sod. Boro-Benz.]

	Metric	Old form
Sodium Borate, in fine powder	43 Gm.	1 oz. av. 315 grains
Sodium Benzoate, in fine powder	57 Gm.	2 oz. av. 122½ gr.
To make	100 Gm.	4 oz. av.

Mix the powders intimately.

Uses.—It has been used as an antiseptic and diuretic and in rheumatism in doses of thirty grains to one drachm (2 to 4 Gm.).

LIQUOR SODÆ ET MENTHÆ. N. F. Solution of Soda and Mint

[Liq. Sod. et Menth.—MISTURA SODÆ ET MENTHÆ, N. F. III. SODA MINT]

	Metric	Old form
Sodium Bicarbonate	50 Gm.	1 oz. av. 293 gr.
Aromatic Spirit of Ammonia	10 mils	154 min.
Spearmint Water, a sufficient quantity,		
To make	1000 mils	2 pints

Dissolve the sodium bicarbonate in 750 mils [old form 24 fl. oz.] of spearmint water, add the aromatic spirit of ammonia, then sufficient spearmint water to make the product measure 1000 mils [old form 2 pints] and filter.

Uses.—It is used as an antacid in doses of two fluidrachms (8 mils), and for those who prefer the flavor, the N. F. directs that Peppermint Water may be used in place of the Spearmint Water.

LIQUOR SODII BORATIS COMPOSITUS. N. F. Compound Solution of Sodium Borate

[Liq. Sod. Bor. Co.—DOBELL'S SOLUTION]

	Metric	Old form
Sodium Borate	15 Gm.	219 grains
Sodium Bicarbonate	15 Gm.	219 grains
Liquefied Phenol	3 mils	46 min.
Glycerin	35 mils	1 fl. oz. 58 min.
Water, a sufficient quantity,		
To make	1000 mils	2 pints

Dissolve the sodium borate and sodium bicarbonate in about 500 mils [old form 1 pint] of water, add the glycerin and liquefied phenol, and allow the mixture to stand half an hour or until the effervescence has ceased; then add sufficient water to make the product measure 1000 mils [old form 2 pints] and filter.

It has been pointed out by Thomas D. McElhenie that if the sodium bicarbonate is dissolved in 500 mils of water, then the phenol added, dissolved in the glycerin, afterwards the sodium borate and lastly enough water to make 1000 mils, there will be no effervescence. When prepared as directed in the N. F. an effervescence always occurs, due to the decomposition of the sodium borate by the glycerin and the freed boric acid liberating CO_2 from the bicarbonate.

Uses.—This solution is used as an alkaline, mildly antiseptic nasal wash or spray.

LIQUOR SODII CITRATIS. N. F. Solution of Sodium Citrate
[Liq. Sod. Cit.—Mistura Sodii Citratis. Potio Rivierii]

	Metric	Old form
Citric Acid	2.00 Gm.	75 grains
Sodium Bicarbonate	2.5 Gm.	91 grains
Distilled Water	100.0 mils	8 fl. oz.

Dissolve the citric acid in distilled water contained in a strong bottle, add the sodium bicarbonate, dissolve it by gentle agitation, and immediately stopper the bottle securely.

This preparation should not be dispensed unless it has been recently prepared.

Uses.—This solution is used as a diuretic and diaphoretic in doses of two to four fluidrachms (8 to 15 mils). Its uses are similar to solution of potassium citrate, although only about one-third the strength.

LIQUOR SODII CITRO-TARTRATIS EFFERVESCENS. N. F.
Effervescent Solution of Sodium Citro-Tartrate
[Liq. Sod. Citro-Tart. Eff.]

	Metric	Old form
Sodium Bicarbonate	26 Gm.	405 grains
Tartaric Acid	24 Gm.	375 grains
Citric Acid	2 Gm.	31 grains
Syrup of Citric Acid	50 mils	1¾ fl. oz.
Distilled Water, a sufficient quantity,		
To make about	350 mils	12 fl. oz.

Dissolve 24 Gm. [old form 375 grains] of the sodium bicarbonate in 250 mils [old form 8½ fl. oz.] of distilled water, add the tartaric and citric acids, and, when they are dissolved, add the syrup of citric acid. Filter the solution into a strong bottle of about 360 mils [old form 12 fl. oz.] capacity, and pass enough distilled water through the filter to make the filtrate measure 300 mils [old form 10¼ fl. oz.]. Dissolve the remainder of the sodium bicarbonate in 50 mils [old form 1¾ fl. oz.] of water, filter the solution, pour it on top of the liquid in the bottle, immediately stopper the bottle securely and shake it.

Uses.—This solution is dispensed in strong, tightly-stoppered bottles, similar to those used for solution of magnesium citrate. It is an effervescent cathartic, the contents of one bottle representing an adult dose.

LIQUOR SODII PHOSPHATIS COMPOSITUS. N. F. Compound Solution of Sodium Phosphate
(Replacing U. S. P. VIII)

[Liq. Sod. Phos. Co.]

	Metric	Old form
Sodium Phosphate, in uneffloresced crystals	1000 Gm.	33 oz. av. 167 gr.
Citric Acid	130 Gm.	4 oz. av. 149 gr.
Glycerin	150 mils	4 fl. oz. 384 gr.
Distilled Water, a sufficient quantity,		
To make	1000 mils	2 pints

Heat the mixture of sodium phosphate and citric acid in a glass or porcelain vessel on a water bath until liquefied. Filter the solution while hot into a vessel which has just previously been rinsed with boiling water. Finally add the glycerin and sufficient distilled water, just previously boiled, to make the product measure 1000 mils [2 pints]. Keep the solution in well-stoppered bottles, in a moderately warm place.

It is important that *uneffloresced* crystals of sodium phosphate be used in making this solution, as it is nearly saturated. Should an effloresced salt be employed with its greater percentage of anhydrous sodium phosphate, the solution is likely to crystallize.

Should sodium phosphate in partly effloresced form be used, the salt should be first covered or thoroughly washed with distilled water, and, when the efflorescence has disappeared, the clear crystals should be removed from the water and air-dried; or a small quantity of the sample may be dried with heat, as directed under *Sodii Phosphas Exsiccatus* (see page 765) and the percentage of moisture determined. When the amount of water present is known, a proportionately smaller quantity of the effloresced salt may be taken.

Uses.—This solution, which represents the salt in the proportion of 1 Gm. in each mil, furnishes a convenient form for the administration of sodium phosphate, the citric acid is added to prevent the salt from crystallizing and the glycerin assists in its preparation, and especially in preventing the development of microörganisms. The dose is two fluidrachms (8 mils).

QUESTIONS ON THE SODIUM SALTS

Why are sodium salts more frequently used than potassium salts? (See page 739.)
Describe sodium.
How may sodium be recognized in its salts?
Sodium hydroxide—Give the formula in symbols and molecular weight.
What are its synonyms?
How is it obtained?
Give rationale of process and chemical reaction; odor, and tests for identity.
How may the following impurities be detected? Organic matter; insoluble impurities; potassium; heavy metals.
Why is sodium hydroxide preferred to potassium hydroxide?
How is it used pharmaceutically?
In what official preparations is it used?
Solution of sodium hydroxide—Give the Latin official name. How is it made?
How much sodium hydroxide does it contain?
By what process is it made officially?
Of what strength should the sodium hydroxide used in this process be; and if not of the proper strength, how can it be used?
By what other process may solution of sodium hydroxide be obtained? Give the outline of this process and chemical reaction; description and specific gravity; odor, taste and tests for identity.
For what is it used ? Give the dose.
Sodium acetate—Give formula in symbols and molecular weight.
How is it obtained? How much water does it contain?
Give rationale of process and chemical reaction.
Describe the odor and taste. Give the solubility and tests for identity.
How may the following impurities be detected? Potassium; arsenic; heavy metals. What is the use and dose?
Sodium arsenate—Give formula in symbols and molecular weight. What is the P. I. title? What is meant by this?
Give the process for making it which was formerly official.
How much water does it contain? Give chemical reaction. What is the use and dose?
What is the Latin title for exsiccated sodium arsenate? How is it prepared?
How may arsenite, as an impurity, be detected? How lead, copper and iron?
What are the advantages of the exsiccated sodium arsenate?

In what official preparation is it used?
Sodium benzoate—Give formula in symbols and molecular weight.
How is it made? Give the chemical reaction.
For what is this salt used medicinally? Into what official preparation does it enter?
Sodium bicarbonate—Give formula in symbols and molecular weight.
How is this prepared? What is the object of washing the commercial bicarbonate?
How much of its weight does it lose on being heated?
What percentage of pure sodium bicarbonate is required in the official preparation?
Give the details for its purification.
How is commercial sodium bicarbonate prepared?
How much water of crystallization does it contain?
How much water of crystallization does sodium carbonate contain?
What is Solvay's process, or the ammonia soda process?
Give rationale of process.
What chemical reaction takes place during the process?
Describe the salt and give solubility and tests for identity.
How may likely impurities be detected?
What is the use and dose?
Sodium benzosulphinide—What are the synonyms. How is it prepared? Give description, odor, taste, and solubility. How may it be identified?
What are its uses and dose?
Sodium borate—Give formula in symbols. What are its synonyms?
Where does the commercial article come from, and how is it obtained?
Where is it found native? How is it made from boric acid?
How much water of crystallization does it contain?
Give odor, taste, solubility and reaction. What are the tests for identity?
How may the following impurities be detected? Carbonate or bicarbonate; heavy metals; arsenic.
What are its medicinal uses?
In what official preparations is it used?
For what is it used in pharmacy?
Sodium bromide—Give formula in symbols and molecular weight.
What percentage of purity is required?
How is this generally made? Give the rationale of the process. Describe the chemical reaction. By what other method may it be made? Give description, odor, taste and solubility.
How may the following impurities be detected? Alkali; iodide; sulphate; heavy metals; bromate. What is the dose and medicinal use?
Sodium cacodylate—What is the chemical name? How is it prepared?
Give description, odor, taste and solubility.
What are the tests for identity?
How detect likely impurities?
Give the use and dose.
Monohydrated sodium carbonate—Give the formula in symbols and molecular weight.
What is Leblanc's process for the manufacture of sodium carbonate?
Give the rationale of the process.
What is soda-waste, and for what is it used?
How much sodium carbonate does the soda-ash thus prepared contain?
How may sodium carbonate be obtained from the bicarbonate, and in what process is it so obtained?
What is the process known as the cryolite process? The solution process?
What is cryolite, and how much sodium is contained in 100 parts of it? What is its formula in symbols?
How is sodium carbonate obtained from cryolite?
Give the rationale of the process.
What is a common name for sodium carbonate?
What are the advantages of the monohydrated sodium carbonate?
How is it prepared? How may sodium carbonate be made electrolytically?
What percentage of water does monohydrated sodium carbonate contain? Describe odor, taste, and chemical reaction. Give the tests for identity.
How may heavy metals be detected if present as an impurity?
What is its use in pharmacy? Give the dose of it.
Sodium chloride—From what source is it obtained?

Describe the odor, taste, solubility and tests for identity. How may likely impurities be detected? What are its pharmaceutical uses?
Physiological solution of sodium chloride—What are the synonyms? How is it made? What special precautions are necessary?
Sodium citrate—Give formula and molecular weight. How is this salt prepared?
Give description, taste, reaction and solubilities. What are the identity tests?
How may an impurity of heavy metals be detected? Of arsenic?
What are its uses and dose?
Sodium cyanide—How is it prepared?
Give description, odor, taste, and solubility.
What are the tests for identity and purity?
Why has this salt replaced the potassium salt?
What are its uses and dose?
Sodium glycerophosphate—How is it prepared?
Give description, odor, taste and solubility.
What are the identity and purity tests?
What are its medicinal uses and dose?
Solution of sodium glycerophosphate—What per cent. of anhydrous salt is represented?
Give description and tests.
Sodium hypophosphite—Give formula in symbols and molecular weight.
How is the salt prepared?
What danger attends the use of too great heat?
What gases are evolved by heat?
What acid is present in this salt, and what is its composition?
Why should it not be prescribed with combinations of mercury or of silver? Describe the odor, taste, and chemical reaction. Give the tests for identity.
How may the following impurities be detected? Sulphides, caustic alkali and carbonate; heavy metals; arsenic; phosphate.
What are its uses in medicine and in pharmacy?
Sodium indigotindisulphonate—What are the synonyms? How is it prepared?
Give description, solubility, tests for identity and impurities.
For what is it used? Why is it preferred to other dyes for this purpose?
Sodium iodide—Give formula in symbols and molecular weight.
How may it be prepared? Give rationale of process. Describe the odor, taste, and chemical reaction. What are the tests for identity?
How is it prepared?
Give taste and chemical reaction and identity tests.
How may the presence of heavy metals be detected?
What are its uses?
Sodium perborate—How much oxygen does this salt represent? How is it made?
Give description, odor, taste, solubility and identity tests. How may heavy metals be detected?
What are its uses and upon what does this depend?
Sodium phenolsulphonate—By what synonym is it known?
What is its formula in symbols?
How may this salt be made? Describe rationale of process. Describe appearance, odor, taste, and chemical reaction. Give the tests for identity.
For what is this salt used? What is the dose?
Sodium phosphate—Give formula in symbols and molecular weight.
By what process may it be prepared? Describe rationale of process.
What per cent. of water of crystallization does it contain?
Describe the appearance, odor, taste, and chemical reaction. Give the tests for identity.
How may the following impurities be detected? Calcium; aluminum; chloride; heavy metals; carbonate; arsenic.
What per cent. of water of crystallization does it contain?
For what is it used medicinally? What is the dose?
What are the official preparations?
What is bone-phosphate or bone-ash?
Sodii phosphas effervescens—What are the ingredients in this preparation? How is it made? How much exsiccated sodium phosphate does it contain? This is equivalent to how much crystallized sodium phosphate? What is the dose?
Sodii phosphas exsiccatus—How is this salt made?

What are its advantages over the crystallized salt?
Sodium salicylate—Give formula in symbols. How is it made?
What precautions must be used in evaporating the solution in order to obtain the salt white and free from the odor of phenol?
Describe the odor, taste, and chemical reaction. Give the tests for identity.
How may the following impurities be detected? Sulphites; thiosulphate; heavy metals.
What is its medicinal use?
What is the dose?
Sodium sulphate—Give formula in symbols and molecular weight.
How is this salt obtained?
What is the common or popular name? Describe appearance, odor, taste, and chemical reaction. Give the tests for identity.
How may the following impurities be detected? Heavy metals; arsenic.
How much water of crystallization does it contain?
For what is this salt used in medicine? What is the dose?
Exsiccated sodium sulphite—Give formula in symbols and molecular weight.
How may this salt be prepared? Describe rationale of process.
What difference is there between the crystallized salt and the granulated salt?
Describe odor, taste, and chemical reaction. Give the tests for identity.
How may impurities of thiosulphate, arsenic or heavy metals be detected?
What is the dose?
Sodium thiosulphate—Give formula in symbols. Give the synonym.
How may it be prepared?
Describe the odor, taste and chemical reaction.
How may the following impurities be detected? Arsenic; heavy metals; calcium.
For what is this salt used? By what abbreviated name is it well known?
Soda with lime—How is it made? What is the synonym? For what is it used?
Sodium boro-benzoate—How is this salt made? What is its medicinal use and dose?
Solution of soda and mint—Give the synonym. What are the ingredients, use, and dose?
Compound solution of sodium borate—What is the synonym? How is it made? Why does the mixture effervesce? How may this be prevented?
Solution of sodium citrate—Give synonyms. How is it prepared? What are its uses and dose?
Effervescent solution of sodium citro-tartrate—How is this solution made and dispensed? For what is it used?
Compound solution of sodium phosphate—What are the ingredients in this preparation? How is it made?
What percentage of crystal sodium phosphate does it contain?
If the sodium phosphate is effloresced, how may this be remedied?
What is its use and dose?

CHAPTER XL

THE LITHIUM SALTS

The lithium salts resemble those of potassium and sodium. The metal lithium is comparatively rare, for although widely distributed in nature, it occurs in such small quantities that the necessary labor to extract it makes it expensive; it is found as a silicate in combination with other metals in certain minerals as *lepidolite, petalite,* and *spodumene,* and in many mineral waters.

Lithium is a metal resembling potassium and sodium, although much less prone to oxidation; it is soft, *and is the lightest of all known metals,* having a specific gravity of about 0.5891. Heated in the air, lithium ignites at a temperature above its fusing point, burning with a bright white light (but its salts burn with an intense red flame); when thrown on water, it oxidizes, but does not fuse like sodium. Chemically, lithium is a monad, like sodium and potassium.

Tests for Lithium Salts

1. A colorless flame is colored a vivid red by volatile salts of lithium.
2. Concentrated solutions of lithium salts yield a white precipitate with ammonium carbonate; no precipitate is produced in dilute solution or if ammonium salts are present.
3. Sodium phosphate produces a white precipitate in alkaline or neutral solutions, which is soluble in acids and in solutions of ammonium salts.

U. S. P. and N. F. Salts of Lithium

Official Name	Preparation
Inorganic Radicals	
Lithii Bromidum, U. S. P.	By decomposing ferrous bromide with lithium carbonate
Carbonas, U. S. P.	By precipitating lithium sulphate with ammonium carbonate
Organic Radicals	
Lithii Citras, U. S. P.	By treating lithium carbonate with citric acid
Salicylas, N. F.	By treating lithium carbonate with salicylic acid

Unofficial Lithium Salts

Lithii Benzoas, U. S. P. VIII Lithium Benzoate	Neutralize lithium carbonate with benzoic acid, in aqueous solution, concentrate and crystallize.
Lithii Borocitras Lithium Borocitrate	Dissolve 20 Gm. citric acid, 4 Gm. lithium carbonate, and 6 Gm. boric acid in sufficient boiling water, evaporate carefully to dryness, and reduce to a powder
Lithii Chloridum, $LiCl$ Lithium Chloride	Neutralize lithium carbonate with hydrochloric acid, concentrate and crystallize
Lithii Diborocitras Lithium Diborocitrate	Dissolve 20 Gm. citric acid, 7 Gm. lithium carbonate and 12 Gm. boric acid in sufficient boiling water, evaporate carefully to dryness, and reduce to a powder
Lithii Iodidum, LiI Lithium Iodide	Digest a solution of calcium iodide with lithium carbonate in slight excess, filter, and evaporate to dryness
Lithii Nitras, $LiNO_3$ Lithium Nitrate	Neutralize lithium carbonate with nitric acid, filter, concentrate, and crystallize
Lithii Phosphas, Li_3PO_4 Lithium Phosphate	Add a solution of lithium carbonate to a solution of sodium phosphate with sodium hydroxide; a crystalline powder will be precipitated
Lithii Sulphas, $Li_2SO_4+H_2O$ Lithium Sulphate	Neutralize lithium carbonate with sulphuric acid, filter, concentrate, and crystallize.

LITHII BROMIDUM. U. S. Lithium Bromide
[Lith. Brom.]

It contains not less than 85 per cent. of LiBr (86.86). Preserve it in air-tight containers.

Preparation.—There are several methods of making this salt: 1. By dissolving lithium carbonate in hydrobromic acid. 2. By mixing solutions of lithium sulphate and potassium bromide. 3. By mixing lithium carbonate, bromine, and water together, and passing hydrogen sulphide gas through the mixture. 4. By placing 300 grains of iron and 2 fluidounces of water in a flask, and adding gradually 1 oz. av. of bromine, shaking with the application of moderate heat until the mixture has acquired a green color and lost the odor of bromine; the solution of ferrous bromide is then filtered, heated, and 200 grains of lithium carbonate are added. The solution is filtered, and evaporated until the salt granulates.

$$\underset{\substack{\text{Ferrous}\\\text{Bromide}}}{FeBr_2} + \underset{\substack{\text{Lithium}\\\text{Carbonate}}}{Li_2CO_3} = \underset{\substack{\text{Lithium}\\\text{Bromide}}}{2LiBr} + \underset{\substack{\text{Ferrous}\\\text{Carbonate}}}{FeCO_3}$$

Official Description.—A white, granular salt; very deliquescent.

Odor, Taste, and Reaction.—Odorless and having a sharp, slightly bitter taste. An aqueous solution of the salt (1 in 20) is neutral or slightly alkaline to litmus.

Solubility.—One Gm. of Lithium Bromide dissolves in 0.6 mil of water at 25° C. (77° F.); also in 0.4 mil of boiling water; freely soluble in alcohol and soluble in ether.

Tests for Identity.—At a low red heat the salt fuses, and at a higher heat it is slowly volatilized. It imparts a crimson color to a non-luminous flame.

Silver nitrate T.S., added to an aqueous solution of the salt (1 in 10), produces a yellowish-white precipitate insoluble in nitric acid or in a moderate excess of ammonia water.

Impurities and Tests for Impurities.—*Iodide.*—Add a few drops of ferric chloride T.S. and 1 mil of chloroform to 10 mils of an aqueous solution of the salt (1 in 20) and shake the mixture. The chloroform does not acquire a violet tint.

Bromate.—Drop 1 mil of diluted sulphuric acid on about 1 Gm. of the powdered salt; no yellow color appears at once.

Chloride.—Dissolve about 0.1 Gm. of Lithium Bromide in 5 mils of distilled water, add an excess of silver nitrate T.S. and a few drops of nitric acid; filter and wash the precipitate with distilled water, then digest it for ten minutes with 5 mils of ammonium carbonate T.S. and filter. On supersaturating the filtrate with nitric acid, not more than a slight turbidity is produced at once.

Sulphate.—Five mils of an aqueous solution of the salt (1 in 100) acidulated with 3 drops of hydrochloric acid shows no immediate turbidity with 1 mil of barium chloride T.S.

Other Alkalies.—Add 5 mils of hydrochloric acid and 5 mils of chlorine T.S. to 0.4 Gm. of Lithium Bromide contained in a flat-bottomed flask of 50 mils capacity, evaporate the mixture almost to dryness on a water bath, add 10 mils of amyl alcohol and cautiously heat the mixture until the lower aqueous layer has evaporated. Then add 3 drops of hydrochloric acid and boil the solution for three minutes; the resulting insoluble residue, if any, when collected on a filter, washed with amyl alcohol and dried at 110° C. (230° F.), weighs not more than 0.002 Gm. The removal of water from the amyl alcohol mixture is facilitated by passing a current of air through the hot solution.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Introduce into a tared weighing-bottle about 0.35 Gm. of Lithium Bromide, stopper, weigh accurately, and proceed as directed under the Assay for bromides (see U. S. P., Test No. 5, Chapter LXII). It shows not less than 85 per cent. of LiBr.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.008686 Gm. of LiBr. Each gramme of Lithium Bromide corresponds to not less than 97.9 mils of tenth-normal silver nitrate V.S.

N. F. Preparations.—Elixir Lithii Bromidi; Syrupus Bromidorum.

Uses.—Lithium bromide is probably the most efficient of all the bromides as an hypnotic. The dose is fifteen to thirty grains (1 to 2 Gm.).

LITHII CARBONAS. U. S. Lithium Carbonate

[Lith. Carb.]

It contains, when dried to constant weight at 100° C. (212° F.), not less than 98.5 per cent. of Li_2CO_3 (73.88). Preserve it in well-closed containers.

Preparation.—Lithium carbonate may be prepared from lepidolite, one of the minerals in which it is found, in the following manner: 10 parts of finely powdered lepidolite, 10 parts of barium carbonate, 5 parts of barium sulphate, and 3 parts of potassium sulphate are fused at a very high temperature in a blast furnace. The heavy silicate and barium sulphate sink to the bottom, and a layer of potassium and lithium sulphate is found at the top of the fused mass. These can be extracted by simple lixiviation, and then the carbonate prepared by double decomposition with ammonium carbonate.

Official Description.—A light, white powder; permanent in the air.

Odor, Taste, and Reaction.—Odorless, and having an alkaline taste. A saturated aqueous solution of the salt is alkaline to litmus.

Solubility.—One Gm. of Lithium Carbonate dissolves in 78 mils of water at 25° C. (77° F.); also in 140 mils of boiling water; almost insoluble in alcohol; dissolved by diluted acids with effervescence.

Tests for Identity.—At a low red heat the salt fuses; at a higher temperature it loses some of its carbon dioxide, and is partially converted into lithium oxide. It imparts a crimson color to a non-luminous flame.

Impurities and Tests for Impurities.—Lithium Carbonate, when dissolved in 40 parts of diluted acetic acid, leaves not more than 0.15 per cent. of insoluble residue.

Mix 1 part of Lithium Carbonate with 20 parts of distilled water and add hydrochloric acid, drop by drop, with agitation until solution takes place. The resulting solution, after boiling and cooling, responds to the following tests when applied to separate portions:

Iron, Aluminum.—The addition of ammonia water to 5 mils of this solution until it has an alkaline reaction produces neither turbidity nor precipitation either before or after boiling.

Heavy Metals.—Dilute another portion of 4 mils of this solution with 6 mils of distilled water; it does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Other Alkalies.—Add a slight excess of diluted hydrochloric acid to 0.2 Gm. of Lithium Carbonate contained in a flat-bottomed flask of 50 mils capacity, evaporate the mixture almost to dryness on a water bath, add 10 mils of amyl alcohol and cautiously heat the mixture until the lower aqueous layer has evaporated. Then add 3 drops of hydrochloric acid and boil the solution for three minutes. The resulting insoluble residue, if any, when collected on a filter, washed with amyl alcohol and dried at 110° C. (230° F.), weighs not more than 0.002 Gm. The removal of the water from the amyl alcohol mixture is facilitated by passing a current of air through the hot solution.

Assay.—Dissolve about 1.5 Gm. of Lithium Carbonate, previously dried to constant weight at 100° C. (212° F.) and accurately weighed, in 50 mils of normal sulphuric acid V.S. and titrate the solution with normal potassium hydroxide V.S., methyl orange T.S. being used as indicator. It shows, in the dried salt, not less than 98.5 per cent. of Li_2CO_3.

Each mil of normal sulphuric acid V.S. used corresponds to 0.03694 Gm. of Li_2CO_3. Each gramme of Lithium Carbonate, previously dried, corresponds to not less than 26.7 mils of normal sulphuric acid V.S.

N. F. Preparations.—Elixir Formatum Compositum; Sal Potassii Bromidi Effervescens Compositus.

Uses.—This salt is the source of the lithium salts, and it is prescribed in gout, in doses of five to fifteen grains (0.32 to 1 Gm.).

LITHII CITRAS. U. S. Lithium Citrate

[Lith. Cit.]

It contains not less than 98.5 per cent. of $Li_3C_6H_5O_7+4H_2O$ (281.92). Preserve it in air-tight containers.

Preparation.—The process formerly official may be usefully employed in making this salt:

Take of lithium carbonate 100 grains; citric acid, in crystals, 200 grains; distilled water 2 fl. oz. Dissolve the citric acid in the water gently heated, and to the solution gradually add the lithium carbonate until perfectly dissolved, heating the solution so long as effervescence is produced. Evaporate, by means of a steam- or sand-bath, to a viscid consistence, dry the residue in an oven, at a temperature of about 115.5° C. (240° F.), then rapidly pulverize it, and preserve the powder in a well-stoppered bottle.

$$\underset{\text{Lithium Carbonate}}{3Li_2CO_3} + \underset{\text{Citric Acid}}{2H_3C_6H_5O_7} = \underset{\text{Lithium Citrate}}{2Li_3C_6H_5O_7} + \underset{\text{Water}}{3H_2O} + \underset{\text{Carbon Dioxide}}{3CO_2}$$

Official Description.—It occurs as a white powder, or in the granular form. It is deliquescent on exposure to moist air and loses its water of crystallization when heated to 150° C. (302° F.).

Odor, Taste, and Reaction.—Odorless, and having a cooling, faintly alkaline taste. An aqueous solution of the salt (1 in 20) is faintly alkaline to litmus but is not reddened by one drop of phenolphthalein T.S.

Solubility.—One Gm. of Lithium Citrate dissolves in 1.4 mils of water at 25° C. (77° F.); very slightly soluble in alcohol.

Tests for Identity.—At a red heat the salt chars, emits inflammable vapors having a pungent odor, and finally leaves a black residue of lithium carbonate mixed with carbon. It imparts a crimson color to a non-luminous flame.

Boil an aqueous solution of Lithium Citrate (1 in 20) with an equal volume of calcium chloride T.S.; a white precipitate forms.

Impurities and Tests for Impurities.—*Other Alkalies.*—Treat the residue obtained by igniting 0.4 Gm. of the salt at a red heat with a slight excess of diluted hydrochloric acid, filter, wash the residue with distilled water, evaporate the filtrate and washings almost to dryness on a water bath, in a flat-bottomed flask of 50 mils capacity, add 10 mils of amyl alcohol and cautiously heat the mixture until the lower aqueous layer has evaporated. Then add 3 drops of hydrochloric acid and boil the solution for three minutes. The resulting insoluble residue, if any, when collected on a filter, washed with amyl alcohol and dried at 110° C. (230° F.), weighs not more than 0.004 Gm. The removal of the water from the amyl alcohol mixture is facilitated by passing a current of air through the hot solution.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Proceed as directed under the Assay for alkali salts of organic acids (see U. S. P., Test No. 6, Chapter LXII). It shows not less than 98.5 per cent. of $Li_3C_6H_5O_7+4H_2O$.

Each mil of half-normal sulphuric acid V.S. used corresponds to 0.04699 Gm. of $Li_3C_6H_5O_7+4H_2O$. Each gramme of Lithium Citrate corresponds to not less than 21 mils of half-normal sulphuric acid V.S.

N. F. Preparations.—Elixir Lithii Citratis; Sal Lithii Citratis Effervescens; Sal Vichyanum Factitium Effervescens cum Lithio.

Uses.—Lithium citrate is used for the same purpose as lithium carbonate; it is more soluble than the latter. The dose is from five to twenty grains (0.32 to 1.3 Gm.).

SAL LITHII CITRATIS EFFERVESCENS. N. F. Effervescent Salt of Lithium Citrate

(U. S. P. VIII.)

[Sal Lith. Cit. Eff.]

	Metric	Old form
Lithium Citrate	50 Gm.	1 oz. av.
Sodium Bicarbonate, dried and powdered	570 Gm.	11 oz. av. 175 gr.
Tartaric Acid, dried and powdered	300 Gm.	6 oz. av.
Citric Acid, uneffloresced crystals	195 Gm.	3 oz. av. 394 gr.
To make about	1000 Gm.	20 oz. av.

Prepare an effervescent salt as directed in the National Formulary General Process (see page 265).

Uses.—This salt forms a pleasant mode of administering a lithium salt; the dose is one to two drachms (4 to 8 Gm.).

LITHII SALICYLAS. N. F. Lithium Salicylate

(U.S.P. VIII)

It contains, when dried to constant weight at 120° C. (248° F.), not less than 98.5 per cent. of $LiC_7H_5O_3$ (143.98). Preserve it in well-closed containers, protected from heat and light.

Preparation.—This salt may be prepared by adding 60 grains of lithium carbonate to 1 fluidounce of distilled water and heating the mixture to boiling, then adding 220 grains of salicylic acid and continuing the heat until effervescence ceases, filtering, and evaporating.

$$\underset{\substack{\text{Lithium}\\\text{Carbonate}}}{Li_2CO_3} + \underset{\text{Salicylic Acid}}{2HC_7H_5O_3} = \underset{\substack{\text{Lithium}\\\text{Salicylate}}}{2LiC_7H_5O_3} + \underset{\text{Water}}{H_2O} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{CO_2}$$

Official Description.—A white or grayish-white powder; deliquescent in a moist atmosphere.

Odor, Taste, and Reaction.—Odorless; taste sweetish. An aqueous solution of the salt (1 in 20) is neutral or slightly acid to litmus.

Solubility.—It is very soluble in water or alcohol.

Tests for Identity.—When heated, the salt is decomposed, emitting the odor of phenol and finally leaving a residue of lithium carbonate and carbon. It imparts a crimson color to a non-luminous flame. Copper sulphate T.S. added to an aqueous solution of the salt (1 in 20) produces a bright green color.

Add a few drops of ferric chloride T.S. to an excess of an aqueous solution of the salt (1 in 4); a deep red color is produced. In a dilute solution of the salt (1 in 100) ferric chloride T.S. produces a deep violet-blue color.

Hydrochloric acid added to an aqueous solution of the salt (1 in 20) produces a voluminous white precipitate of salicylic acid.

Impurities and Tests for Impurities.—*Iron and Organic Coloring Matter.*—An aqueous solution of the salt (1 in 20), when freshly made, is colorless, and

Carbonate.—The solution does not effervesce upon the addition of diluted acids.

Other Alkalies.—Dissolve 0.7 Gm. of the salt in 10 mils of distilled water, add an excess of hydrochloric acid and filter. Evaporate the filtrate almost to dryness on a water bath, in a 50-mil Erlenmeyer flask, and then add 10 mils of amyl alcohol and cautiously heat until the lower aqueous layer is evaporated; then add three drops of hydrochloric acid and boil the liquid for three minutes; the insoluble residue weighs not more than 0.005 Gm. (The removal of the water from the amyl alcohol mixture is facilitated by passing a current of air through the hot solution.)

Heavy Metals.—Dissolve 1 Gm. of the salt in 50 mils of distilled water, precipitate the salicylic acid by the addition of a slight excess of hydrochloric acid and filter; the filtrate does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Incinerate in a porcelain crucible about 2 Gm. of Lithium Salicylate, previously dried to constant weight at 120° C. (248° F.) and accurately weighed, and proceed as directed under the Assay for alkali salts of organic acids (see U. S. P., Test No. 6, Chapter LXII). It shows, in the dried salt, not less than 98.5 per cent. of $LiC_7H_5O_3$.

Each mil of half-normal sulphuric acid V.S. used corresponds to 0.07199 Gm. of $LiC_7H_5O_3$. Each gramme of Lithium Salicylate, previously dried at 120° C. (248° F.), corresponds to not less than 13.7 mils of half-normal sulphuric acid V.S.

N. F. Preparation.—Elixir Lithii Citratis.

Uses.—This salicylate is used, like sodium salicylate, for rheumatism and gout; it is given in doses of fifteen to forty grains (1 to 2.6 Gm.).

QUESTIONS ON THE LITHIUM SALTS

What salts do the lithium salts resemble? How is lithium obtained? (See page 776.)
What is its specific gravity? What is its valence?
What are the tests for lithium salts?
Lithium bromide—Give formula in symbols.
In what various ways may this salt be made? Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected? Iodide; bromate; chloride; sulphate; other alkalies; heavy metals.
For what is it used and what is the dose?
Lithium carbonate—Give formula in symbols. How may it be prepared? Describe appearance, odor, taste, and chemical reaction. What is its use and dose?
Lithium citrate—Give formula in symbols and molecular weight.
What is the process for making it which was formerly official?
Give rationale of process. Describe odor, taste, chemical reaction, and solubility.
Give the tests for identity and impurities. What is its use and dose?
What is the official Latin name of effervescent lithium citrate?
Give its formula and mode of preparation and dose.
Lithium salicylate—Give formula in symbols.
How may it be prepared? Describe rationale of process. Describe appearance, odor, taste, chemical reaction, and solubility. Give the tests for identity.
How may the following impurities be detected? Iron and organic coloring matter; carbonate; other alkalies; heavy metals.
For what is it used and what is the dose?

CHAPTER XLI

AMMONIUM

The ammonium salts resemble those of the alkali metals so closely in their physical and chemical properties that they are appropriately considered in this place.

The metal ammonium has not yet been isolated in the free state, so that its appearance cannot be described. An *ammonium amalgam* is known, however, and is made by dissolving potassium in mercury and adding a strong solution of ammonium chloride to it. It is a spongy, metallic substance, which easily decomposes into ammonia, mercury, and hydrogen.

Tests for Ammonium Salts

1. At high temperatures ammonium compounds are volatilized.
2. When heated with sodium, potassium, or calcium hydroxide, the odor of ammonia is evolved; the latter restores the color of reddened litmus paper, and darkens the blue color of paper moistened with solution of copper sulphate. Ammonia forms a white cloud with vapor of hydrochloric acid.
3. Solution of platinic chloride, with a few drops of hydrochloric acid, if added to a solution of an ammonium salt, produces a yellow precipitate.
4. Ammonium salts are mostly colorless, and generally very soluble in water.
5. Chloroplatinic acid gives with ammonium salts a yellow crystalline precipitate of ammonium chloroplatinate, only slightly soluble in water.

U. S. P. and N. F. Salts of Ammonium

Official Name	Composition and Preparation
Ammonii Benzoas, U. S. P.	By dissolving benzoic acid in ammonia water
Bromidum, U. S. P.	By adding ammonia water gradually to bromine under water
Carbonas, U. S. P.	By subliming a mixture of ammonium chloride and calcium carbonate
Chloridum, U. S. P.	By subliming a mixture of ammonium sulphate and sodium chloride
Iodidum, U. S. P.	By mixing solutions of potassium iodide and ammonium sulphate
Salicylas, U. S. P.	By neutralizing ammonia water with salicylic acid
Valeras, U. S. P.	By passing ammonia gas into monohydrated valeric acid
Hypophosphis, N. F.	By passing ammonia gas into hypophosphorous acid, evaporating and crystallizing
Phosphas, N.F.	By evaporating a solution of phosphoric acid with a slight excess of ammonia

Unofficial Salts and Preparations of Ammonium

Ammonii Arsenas, $(NH_4)_2HAsO_4$ Ammonium Arsenate	Saturate a concentrated solution of arsenic trioxide with ammonia water and allow it to evaporate spontaneously
Ammonii Bicarbonas, NH_4HCO_3 Ammonium Bicarbonate	Treat 1 Gm. powdered ammonium carbonate with 2 Gm. water, and decant the liquid, the residue being the bicarbonate
Ammonii Boras, $2(NH_4HBr_2O_4) + 3H_2O$ Ammonium Borate	Dissolve 1 Gm. boric acid in 3 Gm. warm ammonia water, sp. gr. 0.960, and allow to cool slowly
Ammonii Carbonas Pyro-oleosus Pyro-oleous Ammonium Carbonate	Incorporate thoroughly 32 Gm. ammonium carbonate with 1 Gm. ethereal animal oil
Ammonii Citras, $(NH_4)_3C_6H_5O_7 + 3H_2O$ Ammonium Citrate	Dissolve 1 Gm. citric acid in water, add sufficient ammonia water to neutralize, filter, concentrate, and crystallize
Ammonii Dichromas, $(NH_4)_2Cr_2O_7$ Ammonium Dichromate	Add chromium trioxide to ammonia water, concentrate, and crystallize
Ammonii et Ferri Chloridum Ammonium and Iron Chloride	Mix 32 Gm. ammonium chloride with 9 Gm. solution of ferric chloride, and evaporate to dryness with constant stirring

Unofficial Salts and Preparations of Ammonium—*Continued*

Ammonii et Potassii Tartras Ammonium and Potassium Tartrate	Add ammonium carbonate to a hot solution of acid potassium tartrate until neutralized, evaporate, and crystallize
Ammonii Formas, NH_4CHO_2 Ammonium Formate	Neutralize formic acid with ammonia water, evaporate, and crystallize
Ammonii Fluoridum, NH_4F Ammonium Fluoride	Saturate hydrofluoric acid with ammonia water
Ammonii Nitras, NH_4NO_3 Ammonium Nitrate	Treat ammonium carbonate with nitric acid
Ammonii Nitris, NH_4NO_2 Ammonium Nitrite	Add a solution of ammonium chloride to one of silver nitrate, and evaporate the clear solution over sulphuric acid to dryness
Ammonii Sulphas, $(NH_4)_2SO_4$ Ammonium Sulphate	By saturating gas liquor with sulphuric acid and crystallizing
Ammonii Sulphis, NH_4HSO_3 Ammonium Sulphite	Pass sulphurous acid into an alcoholic solution of ammonia, and collect the precipitate
Ammonii Sulphocyanidum, NH_4CNS Ammonium Sulphocyanide	Dissolve carbon disulphide in alcohol, and heat in the presence of ammonia water. Lastly, concentrate and crystallize.
Spiritus Ammoniæ, U. S. P. VIII Spirit of Ammonia	A 10 per cent. alcoholic solution of NH_3, prepared by heating stronger ammonia water to a temperature not exceeding 60° C. (140° F.) in a flask, connected with a well-cooled glass condenser, leading the vapor to the bottom of a vessel containing alcohol, and adjusting the strength of the spirit by assay

AQUA AMMONIÆ. U. S. Ammonia Water
[Aq. Ammon.]

An aqueous solution of ammonia [$NH_3 = 17.03$] containing not less than 9.5 per cent. nor more than 10.5 per cent. by weight of NH_3. This solution deteriorates on keeping, and must be tested frequently. Preserve it in a cool place in glass-stoppered bottles made of hard glass free from lead.

Preparation.—This useful liquid is rarely prepared by the pharmacist, for the reason that it can be made more economically by the manufacturer. A former official process directed that it be made by mixing and heating ammonium chloride with milk of lime in a retort, collecting the distillate beneath the surface of distilled water contained in the receiver; the reaction was as follows:

$$\underset{\text{Ammonium Chloride}}{2NH_4Cl} + \underset{\text{Calcium Hydroxide}}{Ca(OH)_2} = \underset{\text{Ammonia}}{2NH_3} + \underset{\text{Calcium Chloride}}{CaCl_2} + \underset{\text{Water}}{2H_2O}$$

The manufacturer, however, rarely uses ammonium chloride; the sulphate is cheaper, and it is employed instead. But upon the large scale the ammonia liquor obtained from gas works is used directly as the source, being mixed with milk of lime and heated; the gaseous ammonia is then passed through a series of tubes filled with charcoal, which retain the empyreumatic products. If the tubes are long enough, and sufficient charcoal is employed, a pure product is assured; but much of the commercial ammonia water is empyreumatic through defective purification. Ammonia is also produced in enormous quantities by synthetic methods, either by the direct union of atmospheric nitrogen and hydrogen, by passing the mixture over a catalytic agent, at a temperature between 500° and 700° C. (932°–1292° F.) and under a pressure of two hundred atmospheres, or else from cyanamide or nitrides.

Official Description.—A colorless, transparent liquid.

Odor, Taste, and Reaction.—It has a very pungent characteristic odor, a caustic, alkaline taste and is strongly alkaline to litmus.

Specific Gravity.—About 0.958 at 25° C. (77° F.).

Test for Identity.—Dense white fumes are produced on bringing a glass rod, dipped into hydrochloric acid, near the surface of Ammonia Water.

Impurities and Tests for Impurities.—*Oxidizable and Empyreumatic Substances.*—Add 0.1 mil of tenth-normal potassium permanganate V.S. to 10 mils of Ammonia Water, which has been slightly supersaturated with diluted sulphuric acid; the pink color is not completely destroyed within ten minutes.

Heavy Metals.—When neutralized and made slightly acid with hydrochloric acid, 10 mils of Ammonia Water does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Twenty-five mils of Ammonia Water, when evaporated to dryness in a platinum or porcelain dish and heated to constant weight at 120° C. (248° F.), leaves not more than 0.005 Gm. of residue.

Assay.—Pour about 5 mils of Ammonia Water into a tared, stoppered weighing-bottle containing about 10 mils of distilled water and weigh accurately. Dilute the liquid with 50 mils of distilled water and titrate with normal sulphuric acid V.S., using litmus or methyl orange T.S. as indicator. It shows not less than 9.5 per cent. nor more than 10.5 per cent., by weight, of NH_3.

Each mil of normal sulphuric acid V.S. used corresponds to 0.01703 Gm. of NH_3. Each gramme of Ammonia Water corresponds to not less than 5.57 mils nor more than 6.16 mils of normal sulphuric acid V.S.

U. S. P. Preparations.—Linimentum Ammoniæ; Spiritus Ammoniæ Aromaticus.

N. F. Preparations.—Elixir Ammoniæ Valeratis; Linimentum Ammonii Iodidi; Linimentum Opii Compositum; Linimentum Saponato-Camphoratum; Liquor Ammonii Citratis; Spiritus Ammonii Anisatus; Tinctura Ergotæ Ammoniata.

Uses.—Pharmaceutically, ammonia water is frequently used to precipitate iron salts by combining with the acid radicals, ferric hydroxide being thrown down. Its advantage over the fixed alkalies consists in its volatility, any excess being readily detected by the odor. It is largely used for cleaning fabrics. The strength technically known as "Aqua Ammoniæ F. F. F.," or "20° Ammonia," is employed most frequently in the arts; the latter may be diluted with water, according to the formula given on page 102, if it is desirable to make official ammonia water from it. In round numbers, three parts of 20° ammonia water requires two parts of water to reduce it to the strength of official ammonia water. This is one of the few instances where the Baumé hydrometer degrees are yet used commercially in designating the strength of liquids. In addition to the "20° Ammonia," which represents about 17.5 per cent. of NH_3, a "16° Ammonia," which corresponds to the official 10 per cent. Ammonia water, and "26° Ammonia," which represents the U. S. P. Stronger Ammonia Water, are used technically and are commercial terms. Ammonia water is rarely used internally, the aromatic spirit being preferred. The dose is ten to twenty minims (0.6 to 1.2 mils), largely diluted. Externally, it is caustic and stimulating. Its old name is *Spirits of Hartshorn*, but it is desirable to supplant such names, and use those which are modern; the name *ammonia* is thoroughly established by common usage.

AQUA AMMONIÆ FORTIOR. U. S. Stronger Ammonia Water
[Aq. Ammon. Fort.]

An aqueous solution of ammonia [$NH_3 = 17.03$] containing not less than 27 per cent. nor more than 29 per cent., by weight, of NH_3. This solution deteriorates on keeping, and must be tested frequently. Preserve it in a cool place in partially filled, strong, glass-stoppered bottles made of hard glass free from lead. *Great caution should be used in handling this liquid.*

Preparation.—Stronger ammonia water is prepared in the same way that ammonia water is, the only difference between the two solutions being that of relative strength.

Official Description.—A colorless, transparent liquid.

Odor, Taste, and Reaction.—It has an excessively pungent, characteristic odor and a very caustic and alkaline taste. *Stronger Ammonia Water must never be tasted unless greatly diluted.* Stronger Ammonia Water is strongly alkaline to litmus.

Specific Gravity.—About 0.897 at 25° C. (77° F.).

Tests for Identity and Impurities.—Stronger Ammonia Water, when diluted with twice its volume of distilled water, responds to the tests for identity and purity under *Aqua Ammoniæ.*

Assay.—Pour about 2 mils of Stronger Ammonia Water into a tared flask containing about 50 mils of distilled water, weigh accurately, and titrate with normal sulphuric acid V.S., using litmus or methyl orange T.S. as indicator. It shows not less than 27 per cent. nor more than 29 per cent., by weight, of NH_3.

Each mil of normal sulphuric acid V.S. used corresponds to 0.01703 Gm. of NH_3. Each gramme of Stronger Ammonia Water corresponds to not less than 15.8 mils nor more than 17 mils of normal sulphuric acid V.S.

N. F. Preparation.—Lotio Ammoniacalis Camphorata.

Uses.—This liquid is used externally as a caustic and vesicant, and for making ammonia water by dilution and in the preparation of the petroxolins of the N. F., where it forms an ammonium oleate, and in making Decolorized Tincture of Iodine, also in spirit of ammonia. It is too strong for internal administration.

SPIRITUS AMMONIÆ AROMATICUS. U. S. Aromatic Spirit of Ammonia

[Sp. Ammon. Arom.]

For the details of the formula see page 386.

Official Description.—A nearly colorless liquid when freshly prepared, but gradually acquiring a yellow color.

Odor and Taste.—It has the pungent odor and taste of ammonia.

Specific Gravity.—About 0.900 at 25° C. (77° F.).

Uses.—This is a very valuable and largely used antacid and stimulant. The dose is from twenty to sixty minims (1.2 to 4 mils), largely diluted with water.

LIQUOR AMMONII ACETATIS. U. S. Solution of Ammonium Acetate

[Liq. Ammon. Acet.—SPIRIT OF MINDERERUS]

An aqueous solution containing not less than 7 per cent. of $NH_4C_2H_3O_2$ (77.07), with small amounts of acetic and carbonic acid.

	Metric	Old form
Ammonium Carbonate	**5 Gm.**	365 grains
Diluted Acetic Acid	**100 mils**	16 fl. oz.

Add the ammonium carbonate (which must be in hard, translucent pieces) gradually to the cold diluted acetic acid, and stir until it is dissolved.

This preparation must not be dispensed unless it has been recently prepared.

Solution of Ammonium Acetate may also be prepared in the following manner:

	Metric	Old form
Ammonium Carbonate	**10 Gm.**	1 oz. av. 293 gr.
Acetic Acid (36 to 37 per cent.)	**34 mils**	5 fl. oz. 211 min.
Distilled Water, a sufficient quantity,		
To make	**200 mils**	2 pints

Dissolve the ammonium carbonate in sufficient distilled water to make 100 mils [old form 1 pint], and filter the solution. To the acetic acid add enough distilled water to make 100 mils [old form 1 pint]. Keep the solutions in separate, well-stoppered bottles, and, when Solution of Ammonium Acetate is to be dispensed, measure equal quantities of each solution and mix them.

The reaction involved in this process depends upon the decomposition of the ammonium carbonate with acetic acid; the free carbonic acid is a desirable addition to the solution, which should be dispensed with a moderate amount in solution.

$$\underset{\substack{\text{Acid Ammonium Carbonate}\\ \text{and Carbamate}}}{NH_4HCO_3.NH_4NH_2CO_2} + \underset{\text{Acetic Acid}}{3HC_2H_3O_2} = \underset{\text{Ammonium Acetate}}{3NH_4C_2H_3O_2} +$$

$$\underset{\text{Carbon Dioxide}}{2CO_2} + \underset{\text{Water}}{H_2O}$$

It will be found in practice that the last formula is much more satisfactory than the first. The solutions keep well, and it is very convenient to mix them at the time of dispensing, and thus always be enabled to send out a fresh preparation, which retains sufficient carbonic acid to be agreeable to the patient.

Official Description.—A clear, colorless liquid.

Odor, Taste, and Reaction.—It is free from empyreumatic odor and has a mildly saline, acidulous taste, and an acid reaction.

Tests for Identity.—It is volatile when heated.

Impurities and Tests for Impurities.—Not more than 0.003 Gm. of ash remains on evaporating 20 mils of the Solution and igniting the residue.

When Solution of Ammonium Acetate is heated with potassium hydroxide T.S., ammonia is evolved.

Add 1 mil each of sulphuric acid and alcohol to 5 mils of the Solution and boil the mixture; ethyl acetate is formed, recognizable by its odor.

Assay.—Dilute about 25 mils of Solution of Ammonium Acetate, accurately weighed, with 100 mils of distilled water, transfer it to a distilling flask, render it alkaline with potassium hydroxide T.S. and distil the liquid until all of the ammonia has been driven over (about 100 mils of distillate), receiving the distillate under the surface of 50 mils of normal sulphuric acid V.S. contained in a flask. Then titrate with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows not less than 7 per cent. of $NH_4C_2H_3O_2$.

Each mil of normal sulphuric acid V.S. used corresponds to 0.07707 Gm. of $NH_4C_2H_3O_2$. Each gramme of Solution of Ammonium Acetate corresponds to not less than 0.91 mil of normal sulphuric acid V.S.

U. S. P. Preparation.—Liquor Ferri et Ammonii Acetatis.

Uses.—This solution is used as a diaphoretic and diuretic, in the dose of half a fluidounce (15 mils).

AMMONII BENZOAS. U. S. Ammonium Benzoate
[Ammon. Benz.]

It contains, when dried for twenty-four hours in a desiccator over sulphuric acid, not less than 98 per cent. of $NH_4C_7H_5O_2$ or $C_6H_5.COONH_4$ (139.08). Preserve it in well-closed containers in a cool place.

Preparation.—This salt may be advantageously prepared by a former official process, which is as follows:

Take of benzoic acid 480 grains; ammonia water, 3½ fl. oz., or a sufficient quantity; distilled water, 4 fl. oz. Dissolve the acid in 3½ fl. oz. of the ammonia water, previously mixed with the distilled water; evaporate with a gentle heat, occasionally adding ammonia water, if necessary, to maintain a slight excess of the alkali; then set aside to crystallize, and dry the crystals without heat.

The process is one of direct combination, the reaction being as follows:

$$\underset{\substack{\text{Benzoic}\\\text{Acid}}}{HC_7H_5O_2} + \underset{\substack{\text{Ammonia}\\\text{Water}}}{NH_4OH} = \underset{\substack{\text{Ammonium}\\\text{Benzoate}}}{NH_4C_7H_5O_2} + \underset{\text{Water}}{H_2O}$$

The object of retaining an excess of alkali in the process is to prevent the formation of the acid benzoate, which is less soluble than the official salt.

Official Description.—Thin, white, laminar crystals or a crystalline powder; gradually losing ammonia on exposure to air.

Odor, Taste, and Reaction.—It is odorless or has a slight odor of benzoic acid, a saline, bitter, afterwards slightly acrid taste. An aqueous solution of the salt (1 in 20) is neutral or not more than slightly acid to litmus.

Solubility.—One Gm. of Ammonium Benzoate dissolves in about 10 mils of water, 35.5 mils of alcohol, and about 8 mils of glycerin at 25° C. (77° F.).

Tests for Identity.—When strongly heated it evolves ammonia and benzoic acid, and is finally volatilized, leaving not more than 0.05 per cent. of ash.

An aqueous solution of Ammonium Benzoate (1 in 10) yields with ferric chloride T.S. a pink precipitate, and when such a solution is gently heated with potassium hydroxide T.S., ammonia is evolved.

Impurities and Tests for Impurities.—*Heavy Metals.*—Acidulate 10 mils of an aqueous solution of the salt (1 in 50) with hydrochloric acid and filter it; the filtrate does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dissolve about 0.5 Gm. of Ammonium Benzoate, previously dried for twenty-four hours in a desiccator over sulphuric acid and accurately weighed, in 10 mils of distilled water in a separator. Add to the solution 5 mils of diluted sulphuric acid, and extract the liberated benzoic acid by shaking out with 3 successive portions of 25, 15 and 10 mils respectively of chloroform, passing the chloroform solution through a filter previously moistened with chloroform and removing any benzoic acid adhering to the stem of the funnel with a few mils of chloroform. Evaporate the chloroform solution at a low temperature, preferably spontaneously, to about 5 mils, add 25 mils of diluted alcohol which has been previously neutralized with tenth-normal potassium hydroxide V.S., phenolphthalein T.S. being used as indicator, and titrate this solution with tenth-normal barium hydroxide V.S., using phenolphthalein T.S. as indicator. It shows, in the dried salt, not less than 98 per cent. of $NH_4C_7H_5O_2$.

Each mil of tenth-normal barium hydroxide V.S. corresponds to 0.013908 Gm. of $NH_4C_7H_5O_2$. Each gramme of Ammonium Benzoate, previously dried, corresponds to not less than 70.5 mils of tenth-normal barium hydroxide V.S.

Uses.—Ammonium benzoate is used as a diuretic, in doses of five to twenty grains (0.32 to 1.3 Gm.).

AMMONII BROMIDUM. U. S. Ammonium Bromide
[Ammon. Brom.]

It contains, when dried to constant weight at 100° C. (212° F.), not less than 98.5 per cent. of NH_4Br (97.96). Preserve it in well-closed containers.

Preparation.—Several methods have been employed in making this salt: 1. By double decomposition between solutions of ammonium sulphate and potassium bromide, alcohol being added to separate the ammonium bromide. 2. By adding ammonia water to a solution of ferrous bromide. 3. By Pile's process, one pound of bromine is poured carefully into four times its weight of distilled water in a stone jar, then about one quart of ammonia water is added *very gradually*, a fluidounce at a time, and the top of the jar covered with a glass plate when vapors arise; when all the ammonia has been added, and the solution is free from the smell of bromine, it is evaporated and the salt granulated; the yield is about twenty ounces.

$$\underset{\text{Bromine}}{6Br} + \underset{\text{Ammonia}}{8NH_3} = \underset{\text{Ammonium Bromide}}{6NH_4Br} + \underset{\text{Nitrogen}}{N_2}$$

Official Description.—Colorless, transparent, prismatic crystals, or a white, crystalline or granular powder.

Odor, Taste, and Reaction.—Odorless, of a pungent, saline taste; somewhat hygroscopic. An aqueous solution of the salt (1 in 20) is neutral or not more than slightly acid to litmus.

Solubility.—One Gm. of Ammonium Bromide dissolves in 1.3 mils of water and in 12 mils of alcohol at 25° C. (77° F.); also in 0.9 mil of boiling water and 1.2 mils of boiling alcohol.

Tests for Identity.—When heated, Ammonium Bromide volatilizes without fusing.

An aqueous solution of Ammonium Bromide when gently heated with potassium hydroxide T.S. evolves ammonia.

Silver nitrate T.S. added to an aqueous solution of the salt (1 in 10) produces a yellowish-white precipitate, insoluble in nitric acid or in a moderate excess of ammonia water.

Impurities, and Tests for Impurities.—Add 2 mils of nitric acid to about 2 Gm. of the salt and evaporate the mixture to dryness in a porcelain dish on a water bath and ignite the residue; it yields not more than 0.05 per cent. of non-volatile matter.

Iodide.—Add 1 mil of chloroform to 10 mils of an aqueous solution of the salt (1 in 20) and cautiously introduce chlorine water, which has been diluted with an equal volume of distilled water, drop by drop and with constant agitation. The liberated bromine dissolves in the chloroform and imparts to it a yellow or orange color, which is free from any violet tint.

Bromate.—Drop 1 mil of diluted sulphuric acid upon about 1 Gm. of the powdered salt; no yellow color appears at once.

Iron.—A blue color is not produced at once on adding potassium ferrocyanide T.S. to 20 mils of an aqueous solution of the salt (1 in 250).

Barium.—Add 1 mil of potassium sulphate T.S. to 10 mils of an aqueous solution of Ammonium Bromide (1 in 20), acidulated with acetic acid; no turbidity is produced immediately.

Sulphate.—Under similar conditions the addition of barium chloride T.S. produces no turbidity.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Proceed as directed under the Assay for bromides (see U. S. P., Test No. 5, Chapter LXII), using about 0.4 Gm. of Ammonium Bromide, previously dried to constant weight at 100° C. (212° F.) and accurately weighed. It shows, in the dried salt, not less than 98.5 per cent. of NH_4Br.

Each mil of tenth-normal silver nitrate V.S. corresponds to 0.009796 Gm. of NH_4Br. Each gramme of Ammonium Bromide, previously dried, corresponds to not less than 100.5 mils nor more than 103.4 mils of tenth-normal silver nitrate V.S.

N. F. Preparations.—Elixir Ammonii Bromidi; Elixir Trium Bromidum; Syrupus Bromidorum.

Uses.—Ammonium bromide is sometimes preferred to potassium bromide as an hypnotic and sedative; it is asserted that it does not produce bromism. The dose is from ten to sixty grains (0.65 to 4 Gm.).

AMMONII CARBONAS. U. S. Ammonium Carbonate
[Ammon. Carb.]

It consists of varying proportions of a mixture of acid ammonium carbonate [$NH_4HCO_3 = 79.05$] and ammonium carbamate [$NH_4NH_2CO_2 = 78.07$], and yields not less than 30 per cent. nor more than 32 per cent. of NH_3. Preserve it in well-closed containers in a cool place. For medicinal purposes, use only the translucent portions.

Preparation.—The large consumption of this salt of ammonium has led to several methods of preparation. The one which is most used at present is the dry sublimation of ammonium sulphate with chalk or calcium carbonate; by double decomposition calcium sulphate and ammonium carbonate are produced.

$$\underset{\substack{\text{Ammonium}\\ \text{Sulphate}}}{2(NH_4)_2SO_4} + \underset{\substack{\text{Calcium}\\ \text{Carbonate}}}{2CaCO_3} = \underset{\substack{\text{Acid Ammonium Carbonate}\\ \text{and Carbamate (Official)}}}{NH_4HCO_3.NH_4NH_2CO_2} + \underset{\text{Water}}{H_2O} + \underset{\text{Ammonia}}{NH_3} + \underset{\text{Calcium Sulphate}}{2CaSO_4}$$

The advantage claimed for the use of ammonium sulphate over ammonium chloride is simply that of greater economy.

Official ammonium carbonate is, chemically, a mixed salt. It consists approximately of one molecule of acid ammonium carbonate or bicarbonate and one of ammonium *carbamate;* the latter may be regarded as ammonium carbonate minus a molecule of water. If ammonium carbamate is dissolved in water, it is soon changed to normal ammonium carbonate.

$$\underset{\substack{\text{Ammonium}\\ \text{Carbamate}}}{NH_4NH_2CO_2} + \underset{\text{Water}}{H_2O} = \underset{\substack{\text{Normal Ammonium}\\ \text{Carbonate}}}{(NH_4)_2CO_3}$$

Hence an aqueous solution of commercial ammonium carbonate contains both the neutral and acid carbonates. If the official ammonium carbonate is exposed to the air, it is soon changed into the acid carbonate or bicarbonate, through loss of ammonia, and it is thus depreciated in quality. The bicarbonate may be converted back into the carbonate by treating it with ammonia water. This fact is officially recognized in the preparation of aromatic spirit of ammonia, and *smelling salts* is frequently made by coarsely grinding ammonium carbonate, placing it in a bottle, adding strong ammonia water until it is saturated, and perfuming, usually with oil of lavender. The reaction is as follows:

$$\underset{\substack{\text{Ammonium}\\ \text{Bicarbonate}}}{NH_4HCO_3} + \underset{\text{Ammonia}}{NH_3} = \underset{\substack{\text{Normal Ammonium}\\ \text{Carbonate}}}{(NH_4)_2CO_3}$$

The principal impurity in the commercial salt is empyreuma; the U. S. P. test excludes this.

Official Description.—White, hard, translucent, striated masses. On exposure to the air, the salt loses both ammonia and carbon dioxide, becoming opaque, and is finally converted into friable, porous lumps, or a white powder.

Odor, Taste, and Reaction.—It has a strong odor of ammonia, without empyreuma, and a sharp, ammoniacal taste. An aqueous solution of the salt (1 in 20) effervesces with acids, and is alkaline to litmus.

Tests for Identity.—When heated, Ammonium Carbonate is volatilized, without charring, the vapor showing a strongly alkaline reaction with litmus; not more than 0.05 per cent. of residue remains.

Solubility.—One Gm. of Ammonium Carbonate dissolves very slowly in 4 mils of water at 25° C. (77° F.); it is decomposed by hot water, with the elimination of carbon dioxide and ammonia. By prolonged boiling with water the salt is completely volatilized. Alcohol dissolves the carbamate, leaving the acid carbonate.

Impurities and Tests for Impurities.—*Heavy Metals.*—An aqueous solution of the salt (1 in 50), when slightly supersaturated with hydrochloric acid, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Sulphate.—Five mils of a similar solution is not immediately affected by barium chloride T.S.

Thiosulphate.—Ten mils of an aqueous solution of the salt (1 in 20), on the addition of a slight excess of silver nitrate T.S. and subsequent supersaturation with nitric acid, neither assumes a brown color.

Chloride.—Nor becomes more than slightly opalescent within two minutes.

Empyreumatic Matter.—On slightly supersaturating an aqueous solution, containing 1 Gm. of the salt, with nitric acid, and then evaporating it to dryness on a water bath, a colorless and odorless residue is obtained.

Assay.—Introduce about 2 Gm. of unaltered, translucent Ammonium Carbonate into a tared weighing-bottle containing 10 mils of distilled water, stopper, weigh accurately and add 40 mils of distilled water and 50 mils of normal sulphuric acid V.S. and when solution is effected titrate the excess of acid with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows not less than 30 per cent. nor more than 32 per cent. of NH_3.

Each mil of normal sulphuric acid V.S. used corresponds to 0.01703 Gm. of NH_3. Each gramme of Ammonium Carbonate corresponds to not less than 17.6 mils nor more than 18.8 mils of normal sulphuric acid V.S.

U. S. P. Preparations.—Liquor Ammonii Acetatis; Magma Bismuthi; Spiritus Ammoniæ Aromaticus.

N. F. Preparations.—Liquor Ferri Salicylatis; Mistura Pectoralis, Stokes.

Uses.—Ammonium carbonate is a stimulant in doses of three to five grains (0.2 to 0.32 Gm.). It is generally administered in mucilaginous syrups. It is frequently used as a leavening agent by bakers and by them is often called "bakers' ammonia."

AMMONII CHLORIDUM. U. S. Ammonium Chloride [Ammon. Chlor.]

It contains, when dried to constant weight at 100° C. (212° F.), not less than 99.5 per cent. of NH_4Cl (53.50).

Preparation.—*Sal ammoniac*, as it is termed commercially, is chiefly made from *gas liquor*, the ammoniacal liquid obtained from gas works during the destructive distillation of the coal. The ammonia is generally neutralized with hydrochloric acid, the solution evaporated and the dry mass sublimed in iron pots. The tough, fibrous sublimate is fitted for pharmaceutical and medicinal purposes by purification. It nearly always contains traces of iron, due to the reaction of a portion of the salt upon the cast iron dome. This may be separated by treatment with ammonia water, by the following process of purification:

Take of commercial ammonium chloride, in small pieces, 22 oz. av.; ammonia water, 5 fl.dr.; water, 2 pints. Dissolve the ammonium chloride in the water, in a porcelain dish, with the aid of heat; add the ammonia water, and continue the heat for a short time; filter the solution while hot, and evaporate to dryness, with constant stirring, at a moderate heat, until it granulates; the ferrous or ferric chloride is converted into insoluble ferric hydroxide, which is filtered out.

Official Description.—A white, crystalline or granular powder, somewhat hygroscopic.

Odor, Taste, and Reaction.—It is without odor, having a cooling and saline taste. An aqueous solution of the salt (1 in 20) in ice-cold water does not show an immediate acid reaction with litmus.

Solubility.—One Gm. of Ammonium Chloride dissolves in 2.6 mils of water, 100 mils of alcohol and in 8 mils of glycerin at 25° C. (77° F.); also in 1.4 mils of boiling water.

Tests for Identity.—Ammonium Chloride, on ignition, is volatilized without fusing.

Silver nitrate T.S. added to an aqueous solution of the salt (1 in 10) produces a white, curdy precipitate, insoluble in nitric acid but readily soluble in ammonia water.

An aqueous solution of the salt, when heated with potassium hydroxide T.S., evolves ammonia.

Impurities and Tests for Impurities.—*Heavy Metals.*—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Sulphocyanate.—When acidulated with hydrochloric acid, 10 mils of an aqueous solution of the salt (1 in 10) does not assume a red color on the addition of a few drops of ferric chloride T.S.

Add 2 mils of nitric acid to 2 Gm. of the salt and evaporate the mixture to dryness in a porcelain dish on a water bath; a white residue is obtained, which, when ignited, yields not more than 0.05 per cent. of non-volatile substances.

Assay.—Proceed as directed under the Assay for chlorides (see U. S. P., Test No. 5, Chapter LXII), using about 0.2 Gm. of Ammonium Chloride, previously dried to constant weight at 100° C. (212° F.) and accurately weighed. It shows, in the dried salt, not less than 99.5 per cent. of NH_4Cl.

Each mil of tenth-normal silver nitrate V.S. corresponds to 0.005350 Gm. of NH_4Cl. Each gramme of Ammonium Chloride, previously dried, corresponds to not less than 186.0 mils of tenth-normal silver nitrate V.S.

U. S. P. Preparation.—Trochisci Ammonii Chloridi.
N. F. Preparation.—Mistura Ammonii Chloridi.

Uses.—Ammonium chloride is a stimulant, and largely used as an addition to expectorant remedies, in doses of five to ten grains (0.32 to 0.65 Gm.). It is sometimes used as an inhalation in catarrh, after drawing the vapors of hydrochloric acid and ammonia into a bottle, where they combine to form ammonium chloride in very fine powder. It should never be combined with potassium chlorate, particularly in compressed tablets; for, although the combination is often desirable from a therapeutic standpoint, in time the tablets explode and serious results have been experienced. The crude form of this salt, *sal ammoniac*, is used largely in solution as an electrolyte for voltaic batteries.

AMMONII IODIDUM. U. S. Ammonium Iodide
[Ammon. Iod.]

It contains, when dried to constant weight at 100° C. (212° F.), not less than 99 per cent. of NH_4I (144.96). Preserve it in small, well-closed containers, protected from light.

Preparation.—This salt may be made by a modification of a former official process, as follows:

Take of potassium iodide in coarse powder, 1920 grains; ammonium sulphate, in coarse powder, 867 grains; boiling distilled water 2 fl. oz.; alcohol, water, each, a sufficient quantity. Mix the salts, add them to the boiling water, stir well, and allow the mixture to cool; then add a fluidounce of alcohol, mix well, and reduce the temperature, by a bath of iced water, to about 4.4° C. (40° F.); throw the mixture into a cool glass funnel, stopped with moistened cotton, and, when the clear solution has passed, pour upon the salt a fluidounce of a mixture containing two parts of water and one part of alcohol. Lastly, evaporate the solution rapidly to dryness, stirring constantly; and preserve the residue in a well-stoppered bottle.

In this process double decomposition takes place, ammonium iodide and potassium sulphate being produced.

$$\underset{\text{Potassium Iodide}}{2KI} + \underset{\text{Ammonium Sulphate}}{(NH_4)_2SO_4} = \underset{\text{Ammonium Iodide}}{2NH_4I} + \underset{\text{Potassium Sulphate}}{K_2SO_4}$$

The object of cooling the mixture and adding alcohol is to cause as much of the potassium sulphate to separate as possible, potassium sulphate being almost insoluble in alcohol.

Official Description.—It occurs in minute, colorless, cubical crystals, or as a white, granular powder. The salt is very hygroscopic, and soon becomes yellow or yellowish-brown on exposure to air and light, owing to the loss of ammonia and the liberation of iodine.

Odor, Taste, and Reaction.—Odorless and having a sharp, saline taste. An aqueous solution of the salt (1 in 20) is neutral or not more than slightly acid to litmus.

Solubility.—One Gm. of Ammonium Iodide dissolves in 0.6 mil of water, 3.7 mils of alcohol and in 1.5 mils of glycerin at 25° C. (77° F.); also in 0.5 mil of boiling water.

Tests for Identity.—When strongly heated, Ammonium Iodide evolves vapor of iodine, and volatilizes without fusing, leaving not more than 0.1 per cent. of residue.

When an aqueous solution (1 in 20) is heated with potassium hydroxide T.S., ammonia is liberated.

Add a few drops of ferric chloride T.S. to 5 mils of an aqueous solution of the salt (1 in 20); iodine is liberated which imparts a violet color to chloroform when shaken with the solution.

Impurities and Tests for Impurities.—*Barium.*—Ten mils of an aqueous solution of Ammonium Iodide (1 in 20), when acidulated with hydrochloric acid, is not rendered turbid by the addition of 1 mil of potassium sulphate T.S.

Iron.—Ten mils of an aqueous solution of the salt (1 in 150) does not at once assume a blue color upon the addition of 3 drops of potassium ferrocyanide T.S.

Free Iodine.—Shake 5 mils of an aqueous solution of the salt (1 in 150) with 1 mil of chloroform; no violet color is imparted to the latter.

Heavy Metals.—An aqueous solution of Ammonium Iodide does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Proceed as directed under the Assay for iodides (see U. S. P., Test No. 5, Chapter LXII), using about 0.5 Gm. of Ammonium Iodide, previously dried to constant weight at 100° C. (212° F.) and accurately weighed in a stoppered weighing-bottle. It shows, in the dried salt, not less than 99 per cent. of NH_4I.

Each mil of tenth-normal silver nitrate V.S. corresponds to 0.014496 Gm. of NH_4I. Each gramme of Ammonium Iodide, previously dried, corresponds to not less than 68.3 mils nor more than 70.1 mils of tenth-normal silver nitrate V.S.

Uses.—Ammonium iodide is used as a resolvent and alterative for the same purposes as potassium iodide. The dose is from three to five grains (0.2 to 0.32 Gm.).

AMMONII SALICYLAS. U. S. Ammonium Salicylate
[Ammon. Salicyl.]

It contains, when dried for twenty-four hours in a desiccator over sulphuric acid, not less than 98 per cent. of $NH_4C_7H_5O_3$ or $C_6H_4(OH)COONH_4$ (155.08). Preserve it in well-closed containers, protected from heat and light.

Preparation.—This salt may be made by adding salicylic acid to ammonia water until nearly saturated, evaporating the solution, crystallizing, and purifying the product by recrystallization.

Official Description.—It occurs in colorless, lustrous, monoclinic prisms, or plates, or as a white, crystalline powder. Permanent in dry air.

Odor, Taste, and Reaction.—Odorless, and having at first a slightly saline, bitter taste, with a sweetish after-taste. An aqueous solution of the salt (1 in 10) is colorless and neutral or slightly acid to litmus.

Solubility.—One Gm. of Ammonium Salicylate dissolves in 1 mil of water and in 3 mils of alcohol at 25° C. (77° F.).

Tests for Identity.—When heated, the salt fuses with decomposition, giving off inflammable vapors and an odor of phenol, and is finally volatilized, leaving not more than 0.1 per cent. of ash.

When an aqueous solution (1 in 10) is heated with potassium hydroxide T.S., ammonia is evolved.

Add a few drops of ferric chloride T.S. to an excess of a concentrated aqueous solution of Ammonium Salicylate (1 in 4); a dark red color and a precipitate are produced. In dilute solution (1 in 100) a deep violet-blue color appears.

Diluted hydrochloric or sulphuric acid produces, in a concentrated aqueous solution of the salt, a voluminous, white precipitate.

Impurities and Tests for Impurities.—*Heavy Metals.*—Acidulate 10 mils of an aqueous solution of Ammonium Salicylate (1 in 50) with hydrochloric acid and filter; the filtrate does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dissolve about 0.5 Gm. of Ammonium Salicylate, previously dried for twenty-four hours in a desiccator over sulphuric acid and accurately weighed, in 10 mils of distilled water in a separator. Add to the solution 5 mils of diluted sulphuric acid, and extract the liberated salicylic acid by shaking out with three successive portions of 25, 15 and 10 mils respectively of chloroform, passing the chloroform solution through a filter previously moistened with chloroform and removing any salicylic acid adhering to the stem of the funnel with a few mils of chloroform. Evaporate the chloroform to about 5 mils, add 25 mils of diluted alcohol which has been previously neutralized with tenth-normal potassium hydroxide V.S., phenolphthalein T.S. being used as indicator, and titrate this solution with tenth-normal barium hydroxide V.S., using phenolphthalein T.S. as indicator. It shows, in the dried salt, not less than 98 per cent. of $NH_4C_7H_5O_3$.

Each mil of tenth-normal barium hydroxide V.S. corresponds to 0.015508 Gm. of $NH_4C_7H_5O_3$. Each gramme of Ammonium Salicylate, previously dried, corresponds to not less than 63.2 mils of tenth-normal barium hydroxide V.S.

Uses.—Ammonium salicylate is preferred to sodium salicylate by many physicians; it is used in gout and rheumatism in doses of three to eight grains (0.2 to 0.5 Gm.).

AMMONII VALERAS. U. S. Ammonium Valerate

[**Ammon. Valer.**—AMMONIUM VALERIANATE]

A compound of ammonia and valeric acid having a somewhat varying composition. Preserve it in well-closed containers.

Preparation.—This valerate, formerly called valerianate, may be prepared by passing dried gaseous ammonia into monohydrated valeric acid. The following process may be used:

Take of valeric acid 4 fl. oz.; ammonium chloride, lime, each, a sufficient quantity. From a mixture of ammonium chloride, in coarse powder, and an equal weight of lime, previously slaked and in powder, contained in a suitable vessel, obtain gaseous ammonia, and cause it to pass, first through a bottle filled with pieces of lime, and afterwards into the valeric acid, in a tall, narrow, glass vessel, until the acid is neutralized. Then discontinue the process, and set the vessel aside that the ammonium valerate may crystallize. Lastly, break the salt into pieces, drain it in a glass funnel, dry it on bibulous paper, and keep it in a well-stoppered bottle.

The salt which is found in commerce is usually the acid salt; hence, in making a solution of it, as in the process for elixir of ammonium valerate, the excess of acid should be neutralized by the addition of sufficient ammonia water.

Official Description.—Colorless, or white, quadrangular plates, deliquescent in moist air.

Odor, Taste, and Reaction.—It emits the odor of valeric acid, and has a sharp and sweetish taste. An aqueous solution of the salt (1 in 20) is acid to litmus.

Solubility.—One Gm. of Ammonium Valerate dissolves in 0.3 mil of water and in 0.6 mil of alcohol at 25° C. (77° F.); soluble in ether.

When heated, the salt fuses, gives off vapors of ammonia and valeric acid, and is finally volatilized, leaving not more than 0.05 per cent. of residue.

Tests for Identity.—When heated with potassium hydroxide T.S., an aqueous solution (1 in 20) evolves ammonia.

Supersaturate slightly a concentrated aqueous solution of Ammonium Valerate with sulphuric acid; an oily layer of valeric acid rises to the surface.

Impurities and Tests for Impurities.—*Acetate.*—Precipitate completely 10 mils of an aqueous solution of the salt (1 in 20) with ferric chloride T.S.; the filtrate does not possess a deep red color.

Heavy Metals.—An aqueous solution of the salt (1 in 50), when slightly acidulated with hydrochloric acid and filtered through a small, wetted filter, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

N F. Preparation.—Elixir Ammonii Valeratis.

Uses.—Ammonium valerate is used in hysteria, neuralgia, and similar diseases as a nervine, in doses of five to twenty grains (0.32 to 1.3 Gm.).

LIQUOR AMMONII CITRATIS. N. F. Solution of Ammonium Citrate

[Liq. Ammon. Cit.]

	Metric	Old form
Citric Acid	125 Gm.	4 oz. av. 76 gr.
Ammonia Water,		
Distilled Water, each, a sufficient quantity,		
To make	1000 mils	2 pints

Dissolve the citric acid in 600 mils [old form about 19 fl. oz.] of distilled water, add 300 mils [old form about 9½ fl. oz.] of ammonia water, then cautiously add more ammonia water until a neutral solution is obtained, using litmus paper as an indicator. Cool the solution and add sufficient distilled water to make the product measure 1000 mils [old form 2 pints].

Filter, and preserve this Solution in bottles free from lead.

Uses.—It is used as a diuretic and diaphoretic, like Solution of Ammonium Acetate, in a dose of one fluidrachm (4 mils).

AMMONII HYPOPHOSPHIS. N. F. Ammonium Hypophosphite

[Ammon. Hypophos.]

It contains, when dried to constant weight at 100° C. (212° F.), not less than 97.5 per cent. of $NH_4PH_2O_2$ (83.10). Preserve it in well-closed containers.

Preparation.—It may be prepared by neutralizing hypophosphorous acid with ammonia, concentrating and crystallizing.

Official Description.—It occurs in deliquescent, colorless, hexagonal plates, or as a granular powder.

Odor, Taste, and Reaction.—Odorless and having a saline and bitter taste. An aqueous solution of the salt (1 in 20) is neutral or slightly acid to litmus.

Solubility.—One gramme dissolves in about 1 mil of water, and in about 20 mils of alcohol at 25° C. (77° F.); very soluble in boiling water or boiling alcohol.

Tests for Identity.—When heated, the salt is decomposed with the evolution of hydrogen phosphide, which is spontaneously inflammable.

When heated with sodium hydroxide, an aqueous solution (1 in 20) gives off ammonia.

An aqueous solution of the salt (1 in 20) slightly acidulated with sulphuric acid yields with silver nitrate T.S. a white precipitate, which rapidly turns brown or black through the separation of metallic silver. Another portion of the solution, slightly acidulated with sulphuric acid, yields, on heating with copper sulphate T.S., a reddish-brown precipitate.

Impurities and Tests for Impurities.—*Calcium Salt.*—Ten mils of an aqueous solution of the salt (1 in 20) remains clear for five minutes after the addition of 5 mils of ammonium oxalate T.S. and a few drops of ammonia water.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Boil 5 mils of an aqueous solution of the salt (1 in 25) with 3 mils of sodium hydroxide solution until the ammonia is expelled, add 5 mils of nitric acid, and evaporate to dryness on a water bath; the residue meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Dissolve about 0.2 Gm. of Ammonium Hypophosphite, previously dried to constant weight at 100° C. (212° F.), and accurately weighed, in 10 mils of distilled water, add 3 mils of sodium hydroxide T.S. and boil until the ammonia is expelled. Then add 5 mils of nitric acid and evaporate the solution to dryness on a water bath. Add 1 mil of nitric acid and again evaporate it to dryness on a water bath. Dissolve the residue in 20 mils of distilled water, transfer it to a 200-mil graduated flask, add a drop of phenolphthalein T.S. and sufficient sodium hydroxide T.S. (free from chloride) to produce a pink color, and then add 100 mils of tenth-normal silver nitrate V.S. and agitate well. Now gradually add zinc oxide (free from chloride) in small portions until the liquid is neutral to litmus, and then sufficient distilled water to make the mixture measure 200 mils. Agitate the mixture thoroughly, filter it through a dry filter and collect 100 mils of the filtrate (representing one-half of the Ammonium Hypophosphite taken). Add to this 2 mils of nitric acid and 2 mils of ferric ammonium sulphate T.S. and titrate with tenth-normal potassium sulphocyanate V.S. to the production of a permanent red color. It shows not less than 97.5 per cent. of $NH_4PH_2O_2$.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.00277 Gm. of $NH_4PH_2O_2$. Each gramme of Ammonium Hypophosphite corresponds to not less than 352.0 mils of tenth-normal silver nitrate V.S.

N. F. Preparation.—Syrupus Ammonii Hypophosphitis.

Uses.—It is used as an alterative in doses of three grains (0.2 Gm.).

AMMONII PHOSPHAS. N. F. Ammonium Phosphate
[Ammon. Phos.]

It contains diammonium hydrogen phosphate [$(NH_4)_2HPO_4 = 132.13$] and ammonium dihydrogen phosphate [$NH_4H_2PO_4 = 115.09$], corresponding to not less than 20 per cent. of combined ammonia ($NH_3 = 17.03$). Preserve it in well-closed containers in a cool place.

Preparation.—It is made by evaporating a solution prepared by adding an excess of ammonia to phosphoric acid.

Official Description.—It occurs in colorless crystals, or as a white crystalline powder, losing ammonia on exposure to the air.

Reaction.—An aqueous solution (1 in 20) is neutral or alkaline to litmus.

Solubility.—One gramme dissolves in about 4 mils of water; it is insoluble in alcohol.

Tests for Identity.—Separate portions of an aqueous solution of the salt (1 in 20), yield with magnesia mixture T.S. a white precipitate, with silver nitrate T.S. a yellow precipitate, and, upon warming with ammonium molybdate T.S., a yellow precipitate.

Impurities and Tests for Impurities.—*Calcium, Aluminum.*—Dissolve 1 Gm. of Ammonium Phosphate in 20 mils of distilled water; the resulting solution is not more than slightly turbid.

Chloride.—Ten mils of an aqueous solution of the salt (1 in 100), acidulated with nitric acid, is not rendered more than slightly opalescent by silver nitrate T.S.

Sulphate.—Ten mils of an aqueous solution of Ammonium Phosphate (1 in 100) mixed with 2 mils of hydrochloric acid is not rendered turbid at once by the addition of a few drops of barium chloride T.S.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of the salt meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Transfer about 1 Gm. of Ammonium Phosphate, accurately weighed, to a distilling flask, dissolve it in 300 mils of distilled water and add 25 mils of an aqueous solution of sodium hydroxide (1 in 4). Connect the flask with a small glass condenser, the lower outlet tube of which is inserted beneath the surface of 50 mils of half-normal sulphuric acid V.S., contained in a flask of about 500 mils capacity, and distil the liberated ammonia into the acid. Titrate the excess of acid with half-normal potassium hydroxide V.S., using methyl orange T.S., as an indicator, and calculate the percentage of ammonia in the salt. It shows not less than 20 per cent. of NH_3.

Each mil of half-normal sulphuric acid V.S. used corresponds to 0.008515 Gm. of NH_3. Each gramme of Ammonium Phosphate corresponds to not less than 23.5 mils of half-normal sulphuric acid V.S.

N. F. Preparation.—Liquor Phosphatum Compositus.

Uses.—It is used mainly as a diuretic in doses of five to twenty grains (0.32 to 1.3 Gm.).

QUESTIONS ON AMMONIUM

Is ammonium a metal? Has it been isolated? (See page 782.)
What is ammonium amalgam?
What are the tests for ammonium salts?
Ammonia—Give formula in symbols and molecular weight.
What is ammonia water?
How much by weight of the gas does it contain?
By what process may it be made?
What is its specific gravity? Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected? Oxidizable and empyreumatic substances; heavy metals; fixed impurities.
For what is ammonia water frequently used? What is "20° ammonia"?
What is an old name for this substance?
What is the dose?
Stronger ammonia water—How much by weight of the gas does this contain?
Give description and specific gravity.
For what is stronger ammonia water used?
Aromatic spirit of ammonia—Give Latin official name. How is it made?
Why does this preparation become dark-colored upon being kept? Give description and specific gravity.
Why is precipitation very apt to take place?
What is the object of adding aqua ammoniæ? What is the dose?
What is spirit of Mindererus? Give Latin official name.
How is it made? What is the alternative formula?
Give rationale of process. Which of the formulas is the more satisfactory and why?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is its use medicinally? What is the dose?
Ammonium benzoate—Give Latin official name and formula in symbols.
Describe the process formerly official for making it. Describe rationale of process.
What is the object of retaining an excess of alkali?
Describe the odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurities of heavy metals be detected?
For what is it used in medicine? What is the dose?
Ammonium bromide—Give Latin official name, formula in symbols, and molecular weight.
By what different methods may this be prepared?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected? Iodide; bromate; iron; barium; sulphate ; heavy metals. What is its use and dose?
Ammonium carbonate—Give Latin official name, composition and strength.
Which is the usual process for making this salt? Give rationale of process.
Why is ammonium sulphate preferred to ammonium chloride?
What is official ammonium carbonate, chemically?
If the official salt is exposed to the air, what change takes place?
How may the bicarbonate be converted into carbonate?
How may "smelling salts" be made?
What is the principal impurity in the commercial salt, and how may it be detected?
What is the official description?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected? Heavy metals; sulphate; thiosulphate; chloride; empyreumatic substances.
For what is ammonium carbonate used medicinally?
How is it used pharmaceutically? Give the dose.
Ammonium chloride—Give Latin official name and formula in symbols.
What are its common or popular names? How is it obtained?
How may it be purified from traces of iron?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected? Heavy metals; sulphocyanate; non-volatile substances.
For what is it used in medicine? Give the dose.

What precaution should be observed in compounding it?
Ammonium iodide—Give Latin official name and formula in symbols.
Describe the process by which it may be made
Give rationale of process.
What is the object of cooling the mixture and adding alcohol?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected? Barium; iron; free iodine; heavy metals. What is the dose?
Ammonium salicylate—Give the Latin official name and formula in symbols.
How may this salt be prepared?
Describe its odor, taste, and chemical reaction. What is its solubility. Give tests for identity? How may heavy metals be detected?
What is its use and dose?
Ammonium valerate—What is the synonym?
Describe a process by which it may be prepared.
Why should ammonia water be added to the commercial salt in making solutions of it?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected? Acetate; heavy metals.
For what is it used in medicine and pharmacy?
What is the dose?
Solution of ammonium citrate—How is it made? What is the use and dose?
Ammonium hypophosphite—What is the chemical formula?
How may it be prepared? Give description, odor, taste and solubility.
How may it be identified? How detect calcium salts; heavy metals; arsenic? Give use and dose. What preparation is official in the N. F.?
Ammonium phosphate—What is its chemical name and formula?
How may it be prepared? Give description, odor, taste and solubility.
How may it be identified? How test for calcium; aluminum; chloride; heavy metals; arsenic?
Give use and dose.

CHAPTER XLII

MAGNESIUM, CALCIUM, BARIUM, AND STRONTIUM

Mg; 24.32 Ca; 40.07 Ba; 137.37 Sr; 87.63.

THE compounds of these metals form a natural group. They have numerous physical and chemical characteristics in common. Barium no longer enters into any official salts; although some of its compounds are used in making tests. Strontium salts were first admitted to the U. S. P. 1890, and they are used to a limited extent. Magnesium was formerly classed with the alkali earths, but it is now usually separated from them, because of its closer chemical analogies to zinc. It is so closely allied to the alkali earths in its pharmaceutical and medical aspects that it will be more useful to consider it in its former relation.

Magnesium is widely distributed, the principal minerals being *magnesite*, a carbonate, *dolomite*, a double magnesium and calcium carbonate, *kieserite*, a sulphate, *carnallite*, a double magnesium and potassium chloride, and in the form of silicates as *talc*, *asbestos*, *meerschaum*, *serpentine*, etc. The metal is of a silver-white color, losing its luster through the oxidation of its surface, and burning with a radiant light when heated to redness, magnesium oxide being formed. The oxide, MgO, is official, and is largely used medicinally.

Tests for Salts of Magnesium.

1. The caustic alkalies produce gelatinous, white precipitates with solutions of magnesium salts, insoluble in excess, but soluble in solution of ammonium chloride.

2. Sodium carbonate or potassium carbonate produces white precipitates with solutions of magnesium salts.

3. Solution of sodium phosphate produces a white crystalline precipitate, on the addition of a small quantity of ammonia water, of ammonio-magnesium phosphate, NH_4MgPO_4.

U. S. P. and N. F. Salts of Magnesium

Official Name	Preparation
Magnesii Carbonas, U. S. P. IX	Double decomposition between magnesium sulphate and sodium carbonate
Oxidum, U. S. P. IX	Made by calcining light magnesium carbonate
Oxidum Ponderosum U. S. P. IX	Made by calcining heavy magnesium carbonate
Sulphas, U. S. P. IX	By treating native magnesium hydroxide with sulphuric acid
Chloridum, N. F. IV	Obtained in large quantities from the Stassfurt mines

Unofficial Salts of Magnesium

Magnesii Acetas, $Mg(C_2H_3O_2)_2$ Magnesium Acetate	By dissolving magnesium carbonate in sufficient acetic acid, filtering and concentrating, then crystallizing
Magnesii Iodidum, MgI_2 Magnesium Iodide	By dissolving magnesium oxide in hydriodic acid, filtering, and concentrating, then crystallizing
Magnesii Lactas, $Mg_2C_3H_5O_3+3H_2O$ Magnesium Lactate	By dissolving separately in hot water 6 parts calcium lactate and 5 parts magnesium sulphate, mixing the solutions and filtering, evaporating the filtrate, then crystallizing
Magnesii Salicylas, $MgC_{14}H_{10}O_6+4H_2O$ Magnesium Salicylate	By neutralizing a hot solution of salicylic acid with magnesium carbonate, filtering, evaporating and crystallizing
Magnesii Silicas, $H_2Mg_2Si_3O_9+H_2O$ Magnesium Silicate	Occurs in nature as asbestos, meerschaum, and in other forms
Magnesii Sulphas Exsiccatus, $MgSO_4$ Exsiccated Magnesium Sulphate	By exposing the crystallized sulphate in a warm place until it has lost 35 per cent. of its weight, then sifting it

Unofficial Salts of Magnesium.

Magnesii Sulphis, $MgSO_3+6H_2O$ Magnesium Sulphite	By treating magnesium oxide, in suspension, with sulphurous acid
Magnesii Phenolsulphonas, $Mg(C_6H_5SO_4)+7H_2O$ Magnesium Phenolsulphonate	By mixing concentrated solutions of barium phenolsulphonate and magnesium carbonate and collecting the precipitate
Crab Orchard Salt	A mild saline purgative, consisting mainly of magnesium sulphate, obtained by evaporating the waters of Crab Orchard Springs, Kentucky. *Dose,* from one to two teaspoonfuls

MAGNESII CARBONAS. U. S. Magnesium Carbonate

[Mag. Carb.]

A mixture of hydrated magnesium carbonate and magnesium hydroxide, corresponding to not less than 39.2 per cent. of MgO (40.32) and containing not more than 0.8 per cent. of CaO.

Preparation.—It is largely prepared from *dolomite* ($MgCO_3.CaCO_3$) by first calcining it, suspending the calcined product in water, saturated with CO_2, whereupon the magnesia, being soluble in carbonated water dissolves, forming the bicarbonate ($Mg(HCO_3)_2$). The lime is now separated, the magnesium solution evaporated and the residue heated, liberating CO_2 and water and forming magnesium carbonate. The process of the British Pharmacopœia may also be used; it is as follows: Take of magnesium sulphate 125 Gm.; sodium carbonate 150 Gm.; boiling distilled water, a sufficient quantity. Dissolve the magnesium sulphate and sodium carbonate separately, each in 250 mils of distilled water, mix the solutions, and evaporate to dryness; digest the residue for half an hour with 500 mils of the distilled water, collect the insoluble matter on a calico filter, wash it with distilled water, until the washings are free from sulphates and dry at a temperature not exceeding 100° C. (212° F.).

Magnesium carbonate varies in composition somewhat according to the process used. The reaction in making a carbonate corresponding to that of the Pharmacopœia would be as follows:

$$\underset{\text{Magnesium Sulphate}}{5MgSO_4}+\underset{\text{Sodium Carbonate}}{5Na_2CO_3}+\underset{\text{Water}}{H_2O}=\underset{\text{Magnesium Carbonate}}{4MgCO_3.Mg(OH)_2}+\underset{\text{Sodium Sulphate}}{5Na_2SO_4}+\underset{\text{Carbon Dioxide}}{CO_2}$$

The process for making light magnesium carbonate differs from the above in the substitution of a larger proportion of cold water for the boiling water. This furnishes a good illustration of the rule in precipitation, that dilute solutions produce light precipitates, and dense solutions heavy precipitates.

Official Description.—It occurs in light, white, friable masses, or as a bulky, white powder; permanent in the air.

Odor and Taste.—Without odor, and having a slight, earthy taste.

Solubility.—Magnesium Carbonate is practically insoluble in water, to which, however, it imparts a slightly alkaline reaction; insoluble in alcohol; dissolved by dilute acids with effervescence.

Tests for Identity.—When strongly heated, it loses water and carbon dioxide, and is converted into magnesium oxide.

A solution of Magnesium Carbonate in diluted hydrochloric acid, when mixed with ammonium chloride T.S. and an excess of ammonia water, yields with sodium phosphate T.S. a white crystalline precipitate.

Impurities and Tests for Impurities.—*Soluble Salts.* Heat to boiling 1 Gm. of Magnesium Carbonate with 50 mils of distilled water, and, after cooling, filter and evaporate the filtrate to dryness on a water bath; not more than 0.01 Gm. of residue remains.

Iron.—Dissolve 2.5 Gm. of Magnesium Carbonate in 50 mils of diluted hydrochloric acid and 200 mils of distilled water. The solution is colorless, and a 20-mil portion does not give an immediate blue coloration upon the addition of 5 drops of potassium ferrocyanide T.S.

Heavy Metals.—Dissolve 0.5 Gm. of Magnesium Carbonate in a slight excess of diluted hydrochloric acid (about 5 mils) and dilute with distilled water to 25 mils. Ten mils of this solution does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Calcium Oxide.—Dissolve 4 Gm. of Magnesium Carbonate, in 50 mils of diluted hydrochloric acid, in a beaker of about 800 mils capacity. Dilute this solution to about 400 mils with distilled water, add 5 Gm. of ammonium chloride, heat to boiling, then add 50 mils of ammonium oxalate T.S., followed by 5 drops of methyl orange T.S., and afterward by ammonia water (previously diluted with two volumes of distilled water), added slowly in small portions, stirring constantly, until the liquid has assumed a yellow color. This operation should require about twenty minutes. Allow the liquid to stand for four hours or over night, collect the precipitate on a filter, wash it with hot distilled water, containing 1 per cent. of ammonium oxalate T.S., until the washings, after strongly acidifying with nitric acid, cease to react with silver nitrate T.S. Dissolve the precipitate by pouring 50 mils of warm diluted hydrochloric acid in small portions over the filter, wash the filter with about 100 mils of distilled water, collect the solution of the precipitate and washings in the same beaker, then dilute to 400 mils with distilled water, precipitate, allow to stand, and wash as before, omitting, however, the addition of 5 Gm. of ammonium chloride. Dry the precipitate and filter obtained in the second precipitation and cautiously ignite in a platinum crucible, heating gently at first, gradually increasing the temperature, and finally heating it over a blast lamp for fifteen minutes or longer, if necessary, until of constant weight. Cool the crucible and contents in a desiccator before weighing. The weight of CaO so obtained does not exceed 0.032 Gm., corresponding to not more than 0.8 per cent.

Assay.—Dissolve 1 Gm. of Magnesium Carbonate, in 30 mils of normal sulphuric acid V.S. and determine the residual acid by titrating with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. The amount of normal sulphuric acid V.S. consumed, exclusive of the normal sulphuric acid V.S. corresponding to the calcium oxide found, is not less than 19.44 mils, indicating the presence of not less than 39.2 per cent. of MgO.

Each mil of normal sulphuric acid V.S. corresponds to 0.02016 Gm. of MgO or to 0.028035 Gm. of CaO.

U. S. P. Preparation.—Used in making Liquor Magnesii Citratis; Magma Magnesiæ.

N. F. Preparation.—Mistura Carminativa. Used in the preparation of Elixir Formatum Compositum; Liquor Phosphatum Acidus; Syrupus Eriodictyi Aromaticus.

Uses.—Magnesium carbonate is antacid, and in large doses cathartic. The dose is from thirty to sixty grains (2 to 4 Gm.). It was at one time largely employed in making medicated waters to assist in diffusing the oils used in preparing them, but being slightly soluble it always imparts an alkaline reaction to the water, which is frequently objectionable. Its use in this manner is not recognized by the U. S. P. IX.

MAGNESII OXIDUM. U. S. Magnesium Oxide

[**Mag. Oxid.**—Magnesia Calcined Magnesia Light Magnesia]

It contains, after ignition, not less than 96 per cent. of MgO (40.32) and not more than 2 per cent. of CaO. It contains not more than 10 per cent. of water. Preserve it in well-closed containers.

Preparation.—Magnesium carbonate is exposed in crucibles to a red heat, carbon dioxide and water are expelled, and magnesium oxide is left.

$$\underset{\text{Magnesium Carbonate}}{(MgCO_3)_4Mg(OH)_2} + \underset{\text{Water}}{5H_2O} = \underset{\substack{\text{Magnesium}\\ \text{Oxide}}}{5MgO} + \underset{\substack{\text{Carbon}\\ \text{Dioxide}}}{4CO_2} + \underset{\text{Water}}{6H_2O}$$

Magnesium Oxide is rendered less soluble if heated too strongly. It should always be kept in well-closed vessels; exposure to air and moisture causes the formation of carbonate and hydroxide.

Official Description.—A white, very bulky, and very fine powder. On exposure to the air, it slowly absorbs moisture and carbon dioxide.

Odor and Taste.—Without odor and having an earthy, but not a saline taste.

Solubility.—Magnesium Oxide is almost insoluble in water; insoluble in alcohol dissolved by dilute acids.

Tests for Identity.—A solution of Magnesium Oxide in diluted hydrochloric acid, mixed with ammonium chloride T.S. and an excess of ammonia water, yields with sodium phosphate T.S. a white crystalline precipitate.

Impurities and Tests for Impurities.—*Soluble Salts.*—Heat to boiling 1 Gm. of Magnesium Oxide with 50 mils of distilled water, and, after cooling, filter; the filtrate is not more than faintly alkaline to litmus, and when evaporated to dryness leaves not more than 0.02 Gm. of residue.

Carbonate.—Heat to boiling a mixture of 0.1 Gm. of Magnesium Oxide with 5 mils of distilled water, and, after cooling, pour it into 5 mils of acetic acid. Solution takes place without the evolution of more than a few isolated gas bubbles.

Iron.—Dissolve 1 Gm. of Magnesium Oxide in 50 mils of diluted hydrochloric acid and 200 mils of distilled water. The solution is colorless, and a 20 mil portion does not give an immediate blue coloration upon the addition of several drops of potassium ferrocyanide T.S.

Heavy Metals.—Dissolve 0.5 Gm. of Magnesium Oxide in a slight excess of diluted hydrochloric acid and dilute with distilled water to 25 mils. Ten mils of this solution does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Water.—Transfer to a porcelain crucible about 1 Gm. of Magnesium Oxide, weigh accurately, and expose it to a low red heat; it loses not more than 10 per cent. of its weight.

Calcium Oxide.—To test for calcium proceed as directed under *Magnesii Carbonas,* using about 1.5 Gm. of recently ignited Magnesium Oxide, accurately weighed. It shows not more than 2 per cent. of CaO.

Assay.—Dissolve about 0.5 Gm. of Magnesium Oxide, which has been recently ignited to constant weight and accurately weighed, in 30 mils of normal sulphuric acid V.S. and determine the residual acid by titrating with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. The amount of normal sulphuric acid V.S. consumed, exclusive of the normal sulphuric acid V.S. corresponding to the calcium oxide found, when calculated to 1 Gm. of the ignited Magnesium Oxide, is not less than 47.62 mils, indicating the presence of not less than 96 per cent. of MgO.

Each mil of normal sulphuric acid V.S. used corresponds to 0.02016 Gm. of MgO or to 0.028035 Gm. of CaO.

U. S. P. Preparations.—Ferri Hydroxidum cum Magnesii Oxido; Pulvis Rhei Compositus. It is also used as a diluent and absorbent in extracts and to neutralize the resins in cascara sagrada.

N. F. Preparation.—Massa Copaibæ.

Uses.—Magnesium Oxide or *magnesia* is popularly used as a laxative and antacid, in doses of thirty grains (2 Gm.). In administering, the magnesia should be added to the diluent (water or milk), and not *vice versa.*

MAGNESII OXIDUM PONDEROSUM. U. S. Heavy Magnesium Oxide

[*Mag. Oxid. Pond.*—HEAVY MAGNESIA]

It contains, after ignition, not less than 96 per cent. of MgO (40.32) and not more than 2 per cent. of CaO. It contains not more than 10 per cent. of water. Preserve it in well-closed containers.

Heavy magnesium oxide is preferable to the ordinary magnesium oxide, on account of its density. This often permits the decrease in bulk of the dose in the ratio of nearly four to one. Magnesium oxide is rendered less bulky by trituration, and if the heavy carbonate is used for the calcination, a heavier powder is produced.

Official Description.—A white, dense, and very fine powder.

Odor, Taste, Reaction, Identity, and Impurities.—It conforms to the reactions and tests under *Magnesii Oxidum.*

N. F. Preparation.—Pulvis Rhei et Magnesiæ Anisatus.

Uses.—The uses and dose of heavy magnesia are the same as those of the light magnesia.

MAGMA MAGNESIÆ. U. S. Magnesia Magma
[*Magma Mag.*—MILK OF MAGNESIA]

Magnesia Magma yields not less than 6.5 per cent. nor more than 7.5 per cent. of $Mg(OH)_2$(58.34).

	Metric	Old form
***Magnesium Carbonate**, in fine powder,	125 Gm.	4 oz. av. 76 gr.
Sodium Hydroxide	80 Gm.	2 oz. av. 293 gr.
Distilled Water, a sufficient quantity,		
To make	1000 mils	2 pints

Mix the magnesium carbonate with enough distilled water [about 500 mils (old form 1 pint)] and make a smooth mixture. Dissolve the sodium hydroxide in 400 mils [old form about 12½ fl. oz.] of distilled water, add the solution to the magnesia mixture with constant stirring, and agitate it frequently during fifteen minutes. Wash the resulting magma by decantation, using 2000 mils [old form 4 pints] of distilled water each time until the red color produced in 50 mils [old form 1 fl. oz. 5½ fl. dr.] of the washings by 3 drops of phenolphthalein T.S. is discharged by the addition of 1 drop of diluted sulphuric acid. Then allow the precipitate to subside until it measures 1000 mils [old form 2 pints], decant the supernatant liquid, transfer the product to wide-mouthed bottles, and tightly stopper with corks which have been dipped in melted paraffin.

NOTE.—The distilled water in this preparation may be replaced by water which has been heated to boiling with powdered magnesium carbonate [5 Gm. (73 grains) in each 1000 mils (2 pints)] and then filtered. One-half mil of oil of peppermint, or a sufficient quantity of oil of anise or other suitable flavoring may be added if desired.

This preparation has been made by a number of methods. A largely used process consists of dissolving 220 Gm. of magnesium sulphate in 4000 mils of distilled water and 72 Gm. of sodium hydroxide in 2000 mils of distilled water, heating both solutions to 50° C. (122° F.) and pouring the sodium hydroxide solution slowly in a stream with constant stirring into the magnesium sulphate solution. The magma is then washed until the washings are free from sulphate and the finished product adjusted to 1000 mils.

It is also prepared on a large scale by mixing freshly calcined magnesium oxide with distilled water in proper proportion and, after hydration, which is accompanied by heat, the product is ready for use. This process has not been adopted generally because of the difficulty of obtaining freshly calcined magnesium oxide. One manufacturer has attempted to market such an article in tightly sealed containers. If exposed to the air, magnesium oxide soon loses the property of forming a gelatinous magnesium hydroxide when mixed with water. The official process was suggested by William W. McNeary, of Philadelphia; note that tests are given to detect an excess of alkali or carbonate in the finished product; these may readily be applied by the pharmacist.

Official Description.—A thick, white liquid containing magnesium hydroxide in suspension in water.

Reaction.—It is alkaline to litmus and phenolphthalein.

Tests for Identity and Impurities.—The addition of 2 mils of diluted hydrochloric acid to 1 mil of Magnesia Magma causes the evolution of not more than a few isolated bubbles and the resulting solution is not more than slightly turbid. Add 0.5 Gm. of ammonium chloride to the solution, filter, and render the filtrate alkaline with ammonia water; no precipitate is produced, but upon the addition of sodium phosphate T.S. to this alkaline solution, a white precipitate appears.

Dilute 10 mils of Magnesia Magma with distilled water to make 100 mils, and allow it to stand until the precipitate has settled. Then remove 50 mils of the clear liquid and evaporate it to dryness on a water bath. The residue, when dried to constant weight, does not exceed 0.005 Gm., and, when dissolved in a few mils of distilled water and a drop of methyl orange T.S. added, yields a red color upon the addition of 5 drops of tenth-normal sulphuric acid V.S.

Assay.—Transfer about 5 Gm. of Magnesia Magma to a tared flask, stopper and weigh accurately, add 25 mils of normal sulphuric acid V.S., and, after solution is complete, titrate the excess of acid with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows an amount of magnesium hydroxide corresponding to not less than 6.5 per cent. nor more than 7.5 per cent. of the weight of Magnesia Magma taken.

Each mil of normal sulphuric acid V.S. used corresponds to 0.02917 Gm. of $Mg(OH)_2$. Each gramme of Magnesia Magma corresponds to not less than 2.23 mils nor more than 2.57 mils of normal potassium hydroxide V.S.

U. S. Preparation.—Ferri Hydroxidum cum Magnesii Oxido.

Uses.—It is used as an antacid and laxative and the addition of a flavor, as suggested above, renders it very acceptable when used as an antacid mouth-wash, for which purpose it is frequently used under dentist's orders. The dose is two to three fluidrachms (8 to 12 mils).

MAGNESII SULPHAS. U. S. Magnesium Sulphate

[**Mag. Sulph.** EPSOM SALT]

It contains not less than 48.59 per cent. nor more than 53.45 per cent. of anhydrous magnesium sulphate, corresponding to not less than 99.5 per cent. of the crystallized salt [$MgSO_4+7H_2O=246.50$]. Preserve it in well-closed containers.

Preparation.—This well-known salt is prepared from a number of mineral substances, but in the United States, from a siliceous magnesium hydroxide, which is practically free from lime. The mineral is reduced to a fine powder and treated with sulphuric acid. The mass is then dried and calcined at a red heat, in order to convert into red oxide any ferrous sulphate which may be present. It is then dissolved in water, and calcium sulphide added to separate any remaining portion of iron. The salt is crystallized and dissolved a third time, in order to purify it.

Magnesium sulphate is largely made as a by-product in the manufacture of carbonated waters; the mineral magnesite is decomposed by sulphuric acid and the carbon dioxide passed into the water.

$$\underset{\text{Magnesite}}{MgCO_3}+\underset{\text{Sulphuric Acid}}{H_2SO_4}=\underset{\text{Magnesium Sulphate}}{MgSO_4}+\underset{\text{Carbon Dioxide}}{CO_2}+\underset{\text{Water}}{H_2O}$$

In England, Epsom salt is sometimes prepared from *dolomite*, the double carbonate of magnesium and calcium, by driving off the carbon dioxide by heat, converting the residue into hydroxides, and then treating these with hydrochloric acid. Calcium chloride is formed; this is dissolved out by washing with water, and the purified magnesium oxide is converted into sulphate by treating it with sulphuric acid.

Official Description.—Small, colorless, prismatic needles or rhombic prisms; slowly efflorescent in the air.

Odor, Taste, and Reaction.—Without odor, and having a cooling, saline, and bitter taste. An aqueous solution of the salt (1 in 20) is neutral to litmus.

Solubility.—One Gm. of Magnesium Sulphate dissolves in 1 mil of water at 25° C.

(77° F.); also in about 0.2 mil of boiling water; almost insoluble in alcohol at 25° C. (77° F.).

Tests for Identity.—When exposed to warm air, the salt loses some of its water of crystallization and is converted into a white powder. Further heating removes more water, and at a temperature somewhat above 200° C. (392° F.) it is rendered anhydrous.

An aqueous solution of the salt (1 in 20), when mixed with ammonium chloride T.S. and ammonia water, yields with sodium phosphate T.S. a white, crystalline precipitate. An aqueous solution (1 in 20) yields with barium chloride T.S. a white precipitate insoluble in hydrochloric acid.

Impurities and Tests for Impurities.—*Chloride.*—Add a few drops of silver nitrate T.S. to 10 mils of an aqueous solution of the salt (1 in 20), previously mixed with a few drops of nitric acid; not more than an opalescence is produced.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of the salt meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Dissolve about 1 Gm. of Magnesium Sulphate, accurately weighed, in 100 mils of distilled water, gradually add to the solution, with constant stirring, an excess of sodium phosphate T.S. (about 20 mils), allow to stand for ten minutes, then add 30 mils of ammonia water and allow to stand for four hours. Collect the precipitate on a filter, wash it with dilute ammonia water (1 volume of ammonia water to 3 volumes of distilled water) until 10 mils of the washings, when acidulated with hydrochloric acid, yields no turbidity on the addition of a few drops of barium chloride T.S. Dry and ignite to constant weight. The weight of the magnesium pyrophosphate so obtained corresponds to not less than 48.59 per cent. nor more than 53.45 per cent. of $MgSO_4$.

Each gramme of Magnesium Sulphate corresponds to not less than 0.4495 Gm. nor more than 0.4944 Gm. of magnesium pyrophosphate ($Mg_2P_2O_7$).

U. S. P. Preparation.—Infusum Sennæ Compositum.

N. F. Preparation.—Liquor Magnesii Sulphatis Effervescens; Sal Kissingense Factitium; Sal Kissingense Factitium Effervescens; Sal Vichyanum Factitium; Sal Vichyanum Factitium Effervescens; Sal Vichyanum Factitium Effervescens cum Lithio.

Uses.—Magnesium sulphate is a valuable refrigerant cathartic, in doses of from one-half to one ounce (16 to 31 Gm.); if dissolved in iced water, its nauseous taste is not so perceptible as when water of ordinary temperature is used.

LIQUOR MAGNESII CITRATIS. U. S. Solution of Magnesium Citrate

[Liq. Mag. Cit.]

One hundred mils of the Solution contains magnesium citrate corresponding to not less than 1.5 Gm. of magnesium oxide ($MgO = 40.32$).

	Metric	Old form	
*Magnesium Carbonate	15.0 Gm.	235	gr.
Citric Acid	33.0 Gm.	1	oz. av. 79 gr.
Syrup	60.0 mils.	2	fl. oz.
Purified Talc	5.0 Gm.	78	gr.
Oil of Lemon,	0.1 mils	1.5	min.
Potassium Bicarbonate	2.5 Gm.	39	gr.
Water, a sufficient quantity.			

Dissolve the citric acid in 150 mils [old form 5¼ fl. oz.] of hot water in a suitable dish, and, having added the magnesium carbonate, previously mixed with 100 mils [old form about 3½ fl. oz.] of water, stir until it is dissolved. Then add the syrup, heat the mixed liquids to the boiling point, immediately introduce the oil of lemon, previously triturated with the purified talc, and filter the mixture, while hot, into a strong bottle (previously rinsed with boiling water) of suitable capacity. Introduce enough boiled water to make the product measure 350 mils [old form 12 fl. oz.]. Stopper it with purified cotton until cold, then drop in the potassium bicarbonate, and immediately stopper the bottle securely. Lastly shake the solution occasionally until the potassium bicarbonate is dissolved. Keep the bottle on its side in a cool place, preferably in a refrigerator.

Note.—In this process the 2.5 Gm. [old form 39 grains] of potassium bicarbonate may be replaced by 2.1 Gm. [old form 33 grains] of sodium bicarbonate, preferably in tablet form.

Impurities and Tests for Impurities.—*Tartaric Acid.*—Add 1 mil of glacial acetic acid and 3 mils of an aqueous solution of potassium acetate (1 in 2) to 10 mils of Solution of Magnesium Citrate, shake the mixture vigorously, then gently rub the sides of the test tube with a glass rod for a few minutes and allow to stand for one hour; no white crystalline precipitate, soluble in ammonia water, is produced.

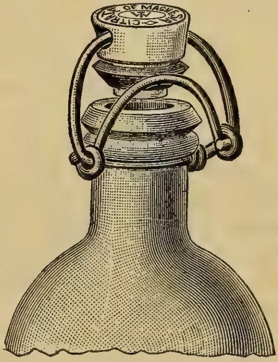
Sulphate.—Dilute 2 mils of the Solution with 8 mils of distilled water and add 5 drops of hydrochloric acid and 1 mil of barium chloride T.S.; no turbidity is produced within one minute.

Calcium.—Dilute 2 mils of the Solution with 8 mils of distilled water and add 5 mils of ammonium oxalate T.S.; not more than a slight turbidity is produced.

Assay.—Transfer 10 mils of Solution of Magnesium Citrate, accurately measured, to a platinum or porcelain dish, evaporate to dryness, and ignite until most of the carbonaceous matter has burned off. Add to the residue 20 mils of diluted hydrochloric acid, heat on a water bath for fifteen minutes, filter if necessary, and wash the residue thoroughly with hot water. To the combined filtrate and washings, which should measure about 100 mils, add an excess of sodium phosphate T.S. (about 20 mils), then add ammonia water gradually, with constant stirring, until slightly alkaline, allow to stand for ten minutes, add 30 mils of ammonia water, and allow to stand for twelve hours. Collect the precipitate on a filter, wash it with dilute ammonia water (1 volume of ammonia water to 3 volumes of water) until 10 mils of the washings, when acidulated with nitric acid, yield not more than an opalescence on the addition of a few drops of silver nitrate T.S. Dry, and ignite to constant weight. The weight of the magnesium pyrophosphate so obtained is not less than 0.414 Gm., indicating an equivalent of not less than 1.5 Gm. of magnesium oxide in 100 mils of the Solution.

A few modifications in the manipulation of the official process are advisable. The 15 Gm. of bulky magnesium carbonate may be replaced by 6.23 Gm. [old form 98 grains] of light calcined magnesia. The syrup should be introduced into the bottle, and the filtered solution of magnesium citrate very carefully poured in without stirring up the syrup. (For this purpose a hard rubber funnel, having the neck closed but with perforations on the side so that the liquid is delivered gently on the sides of the bottle, may be advantageously used.) The potassium bicarbonate, in large crystals (or in compressed blocks of the proper weight), is dropped into the bottle,—they gradually dissolve in the syrup,—and the cork is at once inserted, to prevent loss of carbonic acid gas, but special bottles with patent stoppers are preferred (see Fig. 444). The bottle is not disturbed until it is called for, when a careful shake mixes the solution of the bicarbonate in the bottom of the bottle with the acid liquid above, liberating the carbonic acid gas, and the solution can then always be dispensed in a sparkling condition. Fig. 444 shows the top of an improved form of "citrate bottle" made by the Whitall-Tatum Company. It has many advantages and obviates the troublesome process of using corks for stoppers. It is a modification of the well-known "beer bottle" stopper. A more recent type of "citrate bottle" is closed by a metal cap, clamped into place by a machine which crimps the edges over the lip of the bottle. A composition cork washer beneath the cap renders it air-tight. This form of bottle requires the purchase of a capping machine costing about $5.00, but the bottles are much less

Fig. 444



Top of citrate bottle

expensive than those made with the "beer bottle stopper" and the cap is easily removed and may even be sprung back on the bottle by pressing it against a flat surface should the patient desire to use only a portion of its contents.

Note that the Pharmacopœia has provided tests and an assay for this important solution and pharmacists should closely follow the official formula.

The U. S. P. IX process attempts by the use of heat to eliminate mould spores or other microörganisms which are likely to be present in the solution and cause confervoid growths. If the pharmacist experiences annoyance and loss from this cause, it may be overcome even more effectually by preparing the solution without any attempt at sterilization, then bottling, closing the bottles with absorbent cotton, and afterwards sterilizing them by heating in a closed vessel, containing boiling water. Any form of vessel which will hold the bottles, such as a wash boiler, may be used. The bottles should stand in water to the depth of about an inch, on a raised bottom made of tin or wooden slats and the lid of the vessel placed on loosely. The steam should heat the contents of the bottles to 100° C. (212° F.), and then the boiling continued for at least thirty minutes. The bottles may now be set aside only closed with the cotton stopper and may be kept for an extended period without danger of mould development. When a bottle is to be dispensed, the cotton is removed, the potassium bicarbonate added and the permanent stopper at once inserted.

Uses.—"Solution of citrate of magnesia," as it will probably be always called, is one of the most agreeable cathartics known. It is usually given to adults in the quantity of the official formula, twelve fluidounces (350 mils). The practice of dividing the dose, taking one-half three or four hours after the other, is often preferable.

MAGNESII CHLORIDUM. N. F. Magnesium Chloride
[Mag. Chlorid.]

It contains not less than 95 per cent. of $MgCl_2+6H_2O$(203.34).

Preparation.—It is obtained from *carnallite*, a double potassium and magnesium chloride, by evaporating an aqueous solution to the proper concentration (45° Baumé) when magnesium chloride crystallizes, or by dissolving *magnesite*, magnesium carbonate, in hydrochloric acid. It is also a by-product in the preparation of potassium chloride from *carnallite*.

Official Description.—It occurs as colorless, transparent crystals, or as white, translucent pieces; deliquescent in moist air.

Solubility.—One gramme dissolves in about 0.6 mil of water; it is readily soluble in alcohol.

Reaction.—The aqueous solution of the salt (1 in 20) is neutral to litmus paper.

Tests for Identity.—An aqueous solution of the salt, acidulated with nitric acid, yields a white precipitate upon the addition of silver nitrate T.S.

A mixture of 10 mils of an aqueous solution of the salt (1 in 20) with 10 mils of ammonium chloride T.S., rendered slightly alkaline with ammonia water, yields a white precipitate on the addition of sodium phosphate T.S.

Impurities and Tests for Impurities.—*Substances Insoluble in Alcohol.*—One Gm. of the salt dissolves in 10 mils of alcohol, leaving not more than 1 per cent. of insoluble residue.

Barium.—Add 1 mil of potassium sulphate T.S. to 10 mils of an aqueous solution of the salt (1 in 20), slightly acidulated with hydrochloric acid; no turbidity results.

Iron.—Ten mils of an aqueous solution of the salt (1 in 200), acidulated with hydrochloric acid, is not reddened by potassium sulphocyanate T.S.

Warm 5 mils of an aqueous solution of the salt (1 in 10) with 10 mils of sodium hydroxide T.S.; the odor of ammonia is not evolved.

Calcium.—A mixture of 10 mils of an aqueous solution of the salt (1 in 20), 10 mils of ammonium chloride T.S., and 5 mils of ammonia water, is not rendered more than slightly turbid upon the addition of ammonium oxalate T.S.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of the salt meets the requirements of the Test for arsenic (see U. S. P., Test No. 1 Chapter LXII).

Assay.—Dissolve about 0.5 Gm. of Magnesium Chloride, previously dried and accurately weighed, in 50 mils of distilled water in a 200-mil measuring flask; add 3 mils of nitric acid, then add 50 mils of tenth-normal silver nitrate V.S. and sufficient distilled water to make the mixture measure 200 mils. Mix thoroughly, filter through a dry filter, reject the first 20 mils of filtrate, then collect 100 mils of filtrate, add 2 mils of ferric ammonium sulphate T.S. and titrate the excess of silver nitrate with tenth-normal potassium sulphocyanate V.S.

Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.010167 Gm. of $MgCl_2+6H_2O$. Each gramme of magnesium chloride corresponds to not less than 93.4 mils of tenth-normal silver nitrate V.S.

N. F. Preparation.—Liquor Hydrastinæ Compositus.

Uses.—It is used as a mild purgative in doses of four drachms (16 Gm.).

LIQUOR MAGNESII SULPHATIS EFFERVESCENS. N. F. Effervescent Solution of Magnesium Sulphate

[Liq. Mag. Sulph. Eff.]

	Metric	Old form
Magnesium Sulphate	25.0 Gm.	391 gr.
Citric Acid	4.0 Gm.	63 gr.
Syrup of Citric Acid	60.0 mils	2 fl. oz.
Potassium Bicarbonate, in crystals	2.5 Gm.	39 gr.
Distilled Water, a sufficient quantity		
To make about	350 mils	12 fl. oz

Dissolve the magnesium sulphate and the citric acid in 250 mils [old form about 8½ fl. oz.] of distilled water, add the syrup of citric acid and filter the solution into a strong bottle of about 360 mils [old form about 12 fl. oz.] capacity. Then add sufficient distilled water to nearly fill the bottle, drop in the potassium bicarbonate and immediately stopper the bottle securely. Lastly, shake the bottle occasionally, until the crystals are dissolved.

Uses.—This flavored, effervescent solution of Epsom salt is similar in its action and flavor to the better known solution of magnesium citrate. It must never be used as a substitute for the latter, but it offers an acceptable, effervescent laxative at less cost.

Calcium. Ca; 40.07

Calcium is a very abundant element occurring in nature as carbonate, sulphate, phosphate, silicate, chloride, fluoride, etc. It belongs to the class of metals. When heated, it burns with a bright light. It is of a light yellow color, and is ductile, like gold; it may be hammered into very thin sheets. It forms but one chloride. The oxide, carbonate, sulphate, phosphate, and hypophosphite are of pharmaceutical interest.

Tests for Salts of Calcium

1. Alkaline carbonates produce white precipitates with soluble salts of calcium, insoluble in excess.

2. The soluble oxalates (ammonium or potassium oxalate) produce, even in dilute solutions of calcium salts, a white precipitate of calcium oxalate, insoluble in an excess of acetic acid, but soluble in an excess of hydrochloric acid.

U. S. P. and N. F. Salts of Calcium

Official Name	Preparation
Calx, U. S. P. IX	Made by calcining chalk or limestone
Chlorinata, U. S. P. IX	By treating calcium hydroxide with chlorine
Calcii Bromidum, U. S. P. IX	By dissolving lime in hydrobromic acid
Carbonas Præcipitatus, U. S. P. IX	By double decomposition between calcium chloride and sodium carbonate
Chloridum, U. S. P. IX	By acting on calcium carbonate with hydrochloric acid
Glycerophosphas, U.S.P. IX	By adding glycerophosphoric acid to an excess of milk of lime, filtering out the lime, and concentrating the solution until the salt separates
Hypophosphis, U. S. P. IX	By heating phosphorus with milk of lime
Lactas, U. S. P. IX	By dissolving calcium carbonate in lactic acid and crystallizing
Sulphidum Crudum, U. S. P. IX	By heating dried calcium sulphate, charcoal, and starch to a low red heat
Creta Præparata, U. S. P. IX	By elutriating chalk and forming into cones
Calcii Lactophosphas, N. F.	By mixing calcium carbonate, lactic acid, phosphoric acid and distilled water, and evaporating to dryness without heat, over sulphuric acid
Phosphas Præcipitatus, N. F.	By treating bone ash with hydrochloric acid, precipitating with ammonia water, washing and drying the magma

Unofficial Salts of Calcium

Calcii Benzoas, $Ca(C_7H_5O_2)_2+3H_2O$ Calcium Benzoate	Made by adding calcium carbonate to a hot aqueous solution of benzoic acid, filtering, evaporating, and crystallizing
Calcii Hydroxidum, $Ca(OH)_2$ Calcium Hydroxide	By adding 1 part water to 2 parts lime contained in a metal pot, covering and setting aside to cool, sifting and preserving the fine powder
Calcii Iodas, $Ca(IO_3)_2+6H_2O$ Calcium Iodate	By mixing gradually an alcoholic solution of iodine with excess of filtered aqueous solution of chlorinated lime. After decolorization, slightly acidulating with hydrochloric acid, heating to boiling, filtering, then crystallizing
Calcii Iodidum, CaI_2 Calcium Iodide	By dissolving slaked lime in hydriodic acid and concentrating, then crystallizing. Dose, one to four grains (0.065 to 0.25 Gm.)
Calcii Phenolsulphonas, $Ca(C_6H_5SO_4)_2+6H_2O$ Calcium Phenolsulphonate	By mixing concentrated solutions of barium phenolsulphonate and calcium carbonate and collecting the precipitate
Calcii Salicylas, $Ca(C_7H_5O_3)_2+2H_2O$ Calcium Salicylate	By neutralizing a hot 10 per cent. solution of salicylic acid with calcium carbonate, filtering, evaporating, and crystallizing. Dose, seven to twenty grains (0.45 to 1.3 Gm.) for diarrhœa and gastro-enteritis
Calcii Sulphidum, CaS Calcium Sulphide	By mixing 12 parts powdered gypsum with 4 parts powdered charcoal, and heating the mixture in a covered crucible until gas ceases to be evolved
Calcii Sulphas, $CaSO_4+2H_2O$ Calcium Sulphate	Occurs in nature
Calcii Sulphas Exsiccatus, $CaSO_4$, U.S.P. VIII Exsiccated Calcium Sulphate (Plaster of Paris)	By heating calcium sulphate
Calcii Sulphis, $CaSO_3$ Calcium Sulphite	By mixing concentrated solutions of sodium sulphite and calcium chloride and collecting the precipitate
Calcii Sulphydras, $CaH_2S_2+6H_2O$ Calcium Sulphydrate	By passing hydrogen sulphide into a mixture of 2 parts slaked lime and 3 parts water as long as absorbed
Calcii Thiosulphas, $CaS_2O_3+6H_2O$ Calcium Thiosulphate	Medical properties are those of the sulphites. Dose, from ten to twenty grains (0.65 to 1.3 Gm.)

CALX. U. S. Calcium Oxide
[Lime Quicklime]

It contains, when freshly ignited to constant weight with a blast lamp, not less than 95 per cent. of CaO (56.07). It loses not more than 10 per cent. of its weight on ignition. Preserve it in air-tight containers in a dry place.

Preparation.—Lime, or calcium oxide is a very important alkaline earth, and is made by calcining limestone, or native calcium carbonate, in kilns with strong heat; carbon dioxide and water are expelled.

Official Description.—In hard, white or grayish-white masses or granules, or as a white powder.

Odor, Taste, and Reaction.—Odorless and having a caustic taste. Water, when agitated with Calcium Oxide, becomes alkaline to litmus.

Solubility.—One Gm. of Calcium Oxide dissolves in 840 mils of water at 25° C. (77° F.); also in 1740 mils of boiling water; soluble in glycerin and syrup; insoluble in alcohol.

Tests for Identity.—When moistened with water, Calcium Oxide becomes heated, and is gradually converted into a white powder (calcium hydroxide or slaked lime). When this is mixed with about 3 or 4 times its weight of water, it forms a smooth magma (milk of lime).

Impurities and Tests for Impurities.—*Carbonate.*—Slake 1 Gm. of Calcium Oxide, thoroughly mix it with 50 mils of water, and decant the greater portion of the milky liquid; the addition of an excess of diluted hydrochloric acid to the residue does not cause more than a slight effervescence.

Mix 5 Gm. of Calcium Oxide, after slaking, with 100 mils of distilled water, followed by hydrochloric acid, drop by drop, with agitation until solution takes place. The resulting solution, after boiling and cooling, should be acid and should not deposit more than 0.05 Gm. of insoluble matter.

Ammonium oxalate T.S. added to a portion of this solution, after neutralizing it with ammonia water, yields a white precipitate, insoluble in acetic acid, but soluble in hydrochloric acid.

Volatile Substances.—Ignite to constant weight with a blast lamp in a tared platinum crucible a portion of Calcium Oxide; it loses not more than 10 per cent. in weight of the Calcium Oxide taken.

Assay.—Dissolve about 1 Gm. of Calcium Oxide, previously ignited to constant weight over a blast lamp and accurately weighed, in 20 mils of diluted hydrochloric acid, cool the solution, dilute with distilled water to 100 mils and mix well. Transfer 20 mils of this solution to a 200-mil graduated flask and proceed with the assay as directed under *Calcii Carbonas Præcipitatus* (see page 813).

Each mil of tenth-normal oxalic acid V.S. corresponds to 0.0028035 Gm. of CaO. Each gramme of freshly ignited Calcium Oxide corresponds to not less than 338.9 mils of tenth-normal oxalic acid V.S.

U. S. P. Preparation.—Liquor Calcis.

N. F. Preparations.—Potassa cum Calce; Soda cum Calce.

Uses.—Externally, lime acts as an escharotic; it enters into the composition of many depilatory powders; internally, when converted into the hydroxide, and in solution, it is a valuable antacid.

LIQUOR CALCIS. U. S. Solution of Calcium Hydroxide

[**Liq. Calc.**—LIME WATER]

An aqueous solution containing not less than 0.14 per cent. of $Ca(OH)_2$ (74.09) at 25° C. (77° F.). Preserve it in well-filled, tightly stoppered bottles.

The percentage of calcium hydroxide varies with the temperature at which the solution is prepared, being about 0.17 per cent. at 15° C. (59° F.) and diminishing as the temperature rises.

	Metric	Old form
Lime	**50 Gm.**	1 oz. av. 293 gr.
Distilled Water, a sufficient quantity.		

Slake the lime by the very gradual addition of 1000 mils [old form 2 pints] of distilled water, and agitate it occasionally during half an hour. Allow the suspended particles to subside, decant the supernatant liquid and reject it. Transfer the magma of calcium hydroxide to a filter and wash it repeatedly with boiling distilled water, until the washings, after acidulation with nitric acid, show not more than a faint cloudiness with silver nitrate T.S. (*chloride*). Return the magma to a suitable container, add 5000 mils [old form 10 pints] of distilled water, agitate it thoroughly, allow the mixture to stand for twenty-four hours, agitate again, and, when the coarser particles of solid matter have subsided, pour the liquid holding the undissolved calcium hydroxide in suspension into a bottle having a tight stopper. From time to time shake the bottle to insure a saturated solution. Pour off the clear liquid when required for use.

The undissolved calcium hydroxide must not be used for making additional quantities of Solution of Calcium Hydroxide unless the product is found to be of full strength when assayed.

Lime water is very extensively used in pharmacy; the object of keeping it upon undissolved lime is to insure a saturated solution. Lime is but sparingly soluble in water and less soluble in hot water than in cold; when the solution is heated, a deposition of lime takes place which is redissolved on cooling. A solution of lime containing particles of undissolved lime in suspension is termed *milk of lime.*

Official Description.—A clear, colorless liquid.

Odor, Taste, and Reaction.—Without odor, and having an alkaline taste. It is strongly alkaline to litmus.

Tests for Identity.—It absorbs carbon dioxide from the air, a pellicle of calcium carbonate forming on the surface of the liquid.

On being heated it becomes turbid, due to the separation of calcium hydroxide which redissolves when the liquid is cooled.

Impurities and Tests for Impurities.—*Alkalies and their Carbonates.*—The alkaline reaction of the Solution entirely disappears after it has been saturated with carbon dioxide and subsequently boiled.

Assay.—Titrate 50 mils of Solution of Calcium Hydroxide with tenth-normal sulphuric acid V.S., using phenolphthalein T.S. as indicator; it shows not less than 0.14 per cent. of $Ca(OH)_2$.

Each mil of tenth-normal sulphuric acid V.S. used corresponds to 0.0037045 Gm. of $Ca(OH)_2$. Each mil of Solution of Calcium Hydroxide corresponds to not less than 0.38 mil of tenth-normal sulphuric acid V.S.

U. S. P. Preparation.—Linimentum Calcis.

N. F. Preparations.—Lotio Flava; Lotio Nigra; Pasta Zinci Mollis.

F. W. Nitardy has suggested that lime be slaked in larger quantity than that directed by the Pharmacopœia, the magma washed free from chloride and the moist magma or milk of lime then transferred to small, completely filled bottles and kept until needed for the making of lime water. This plan avoids the necessity of freshly slaking the lime and washing the magma for each lot of lime water. Another suggestion has been the careful selection of lime, and its preservation in hermetically sealed glass tubes in portions just sufficient for one gallon of lime water. Unless protected from the air, lime soon becomes unfit for use, due to the action of carbon dioxide and partial hydration from moisture in the air. Mr. Nitardy also suggests that the lime water be stored in a large bottle from which it may be drawn by means of a glass siphon. A piece of rubber tubing is attached to the outlet of the siphon and is opened or closed by a pinch-cock, when the lime water is to be drawn from the container. This siphon is held in place by a rubber stopper which also carries an air tube leading to a small bottle of solution of sodium hydroxide. By this plan all air admitted to the bottle of lime water is first passed through the NaOH solution and deprived of CO_2. The preparation of lime water involves the following reaction:

$$\underset{\text{Lime or Calcium Oxide}}{CaO} + \underset{\text{Water}}{H_2O} = \underset{\text{Calcium Hydroxide}}{Ca(OH)_2}$$

When it is exposed to the air, which almost always contains CO_2, it is quickly converted into the insoluble carbonate as follows:

$$\underset{\substack{\text{Calcium}\\\text{Hydroxide}}}{Ca(OH)_2} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{CO_2} = \underset{\substack{\text{Calcium}\\\text{Carbonate}}}{CaCO_3} + \underset{\text{Water}}{H_2O}$$

Uses.—Probably the most extensive use of lime water in medicine is in checking nausea. It is usually administered with milk when used for this purpose and is regularly employed with milk in infant feeding. It is employed externally to allay inflammation, and in washes of various kinds. The dose of lime water is from four fluidrachms to two fluidounces (15 to 60 mils).

CALX CHLORINATA. U. S. Chlorinated Lime

The activity of this compound depends upon the amount of chlorine present, and it is therefore most appropriately considered under that head (see page 680).

CALCII BROMIDUM. U. S. Calcium Bromide
[Calc. Brom.]

A hydrated form of Calcium Bromide containing not less than 84 per cent. of $CaBr_2$ (199.91). Preserve it in well-closed containers.

Preparation.—Calcium bromide may be made by the simple process of adding precipitated calcium carbonate, in excess, to hydrobromic acid, filtering, evaporating the solution to dryness, and granulating the product.

It may also be made by adding milk of lime to a boiling solution of ammonium bromide until ammoniacal vapors cease to be evolved. The solution is then filtered and the salt granulated. Care should be used to protect the product from moisture.

$$\underset{\substack{\text{Calcium}\\\text{Carbonate}}}{CaCO_3} + \underset{\substack{\text{Hydrobromic}\\\text{Acid}}}{2HBr} = \underset{\substack{\text{Calcium}\\\text{Bromide}}}{CaBr_2} + \underset{\text{Water}}{H_2O} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{CO_2}$$

Official Description.—A white, granular salt.

Odor, Taste, and Reaction.—Odorless, of a sharp, saline taste. Very deliquescent. An aqueous solution of the salt (1 in 20) is neutral or slightly alkaline to litmus.

Solubility.—One Gm. of Calcium Bromide dissolves in 0.7 mil of water and in 1.3 mils of alcohol at 25° C. (77° F.); also in 0.4 mil of boiling water; insoluble in chloroform or ether.

Tests for Identity.—An aqueous solution of the salt (1 in 20) yields with ammonium oxalate T.S. a white precipitate, insoluble in acetic acid but soluble in hydrochloric acid.

Silver nitrate T.S. added to an aqueous solution of the salt (1 in 10) produces a yellowish-white precipitate, insoluble in nitric acid or in a moderate excess of ammonia water.

Impurities and Tests for Impurities.—*Iodide.*—Add 1 mil of chloroform to 10 mils of an aqueous solution of the salt (1 in 20) and cautiously introduce chlorine water, which has been diluted with an equal volume of distilled water, drop by drop, with constant agitation. The liberated bromine dissolves in the chloroform and imparts to it a yellow to orange color, which is free from any violet tint.

Bromate.—Drop 1 mil of diluted sulphuric acid upon about 1 Gm. of the powdered salt; no yellow color appears at once.

Chlorides.—Dissolve about 0.1 Gm. of the salt in 5 mils of distilled water, add an excess of silver nitrate T.S. and a few drops of nitric acid, filter, wash the precipitate with distilled water, digest it for ten minutes with 5 mils of ammonium carbonate T.S. and filter. On supersaturating the filtrate with nitric acid, not more than a slight turbidity is produced at once.

Iron.—Twenty mils of an aqueous solution (1 in 250) does not at once assume a blue color with potassium ferrocyanide T.S.

Sulphate.—Five mils of an aqueous solution (1 in 20), when acidulated with 1 drop of hydrochloric acid, shows no immediate turbidity with 1 mil of barium chloride T.S.

Barium.—Dissolve 1 Gm. of Calcium Bromide and 1 Gm. of sodium acetate in 5 mils of distilled water and render the solution slightly acid by the addition of a sufficient quantity (from 3 to 5 drops) of diluted acetic acid. After boiling and thoroughly cooling the solution, it does not become cloudy within five minutes after the addition, with agitation, of 5 drops of potassium dichromate T.S.

Magnesium and Alkalies.—Precipitate the calcium completely from 10 mils of an aqueous solution of the salt (1 in 20) by adding ammonium oxalate T.S. and filtering. The filtrate on evaporation and ignition leaves not more than 0.004 Gm. of fixed residue.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Proceed as directed under the Assay for bromides (see U. S. P., Test No. 5, Chapter LXII), using about 0.4 Gm. of Calcium Bromide, accurately weighed in a stoppered weighing-bottle. It shows not less than 84 per cent. of $CaBr_2$. Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.0099955 Gm. of $CaBr_2$. Each gramme of Calcium Bromide corresponds to not less than 84.0 mils of tenth-normal silver nitrate V.S.

N. F. Preparations.—Elixir Calcii Bromidi; Syrupus Bromidorum.

Uses.—Calcium bromide is used as an hypnotic in doses of fifteen to sixty grains (1 to 4 Gm.).

CALCII CARBONAS PRÆCIPITATUS. U. S. Precipitated Calcium Carbonate

[Calc. Carb. Præc.—PRECIPITATED CHALK]

It contains, when dried to constant weight at 200° C. (392° F.), not less than 98 per cent. of $CaCO_3$ (100.07).

Preparation.—This salt is readily prepared by double decomposition. The following process was official in the British Pharmacopœia:

Take of calcium chloride 5 oz. av.; sodium carbonate 13 oz. av.; boiling distilled water a sufficiency. Dissolve the calcium chloride and the sodium carbonate each in 2 pints [Imperial measure] of the water; mix the two solutions; and allow the precipitate to subside. Collect this on a calico filter, wash it with boiling distilled water until the washings cease to give a precipitate with silver nitrate, and dry the product at the temperature of 100° C. (212° F.).

Calcium carbonate precipitates and sodium chloride remains in solution.

$$\underset{\substack{\text{Calcium}\\\text{Chloride}}}{CaCl_2} + \underset{\substack{\text{Sodium}\\\text{Carbonate}}}{Na_2CO_3} = \underset{\substack{\text{Calcium}\\\text{Carbonate}}}{CaCO_3} + \underset{\substack{\text{Sodium}\\\text{Chloride}}}{2NaCl}$$

The fineness of the powder is greatly promoted by using hot, dense solutions.

This salt of calcium is also obtained as a by-product in the process for making solution of chlorinated soda, double decomposition taking place between solution of chlorinated lime and solution of monohydrated sodium carbonate. The precipitated calcium carbonate must be boiled in water, and afterwards thoroughly washed to free it from the chlorinous odor; the product is unfit for internal use.

Official Description.—A fine, white, micro-crystalline powder; permanent in the air.

Odor and Taste.—Without odor or taste.

Solubility.—Precipitated Calcium Carbonate is nearly insoluble in water; the solubility is increased by the presence of ammonium salts and especially by carbon dioxide; alkali hydroxides diminish its solubility; insoluble in alcohol; dissolved with effervescence by diluted acetic, hydrochloric, or nitric acid.

Tests for Identity.—When heated to full redness, the salt gradually loses carbon dioxide, and a residue of calcium oxide remains.

For applying tests of identity and purity, mix 1 Gm. of Calcium Carbonate with 50 mils of distilled water, and add hydrochloric acid, drop by drop, with agitation, until solution takes place. The resulting solution, after boiling and cooling, should be acid, and should not impart a green or crimson color to a non-luminous flame, nor leave more than 0.002 Gm. of insoluble matter.

Neutralize a portion of this acid solution with ammonia water, and add ammonium oxalate T.S.; a white precipitate is produced which is insoluble in acetic acid, but soluble in hydrochloric acid.

Impurities and Tests for Impurities.—*Heavy Metals.*—Another portion of the solution, as prepared above, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Soluble Impurities.—Agitate 1 Gm. of the salt with 50 mils of distilled water, which has previously been boiled and cooled, and then filter; the filtrate is not alkaline to litmus, and, on evaporation, leaves not more than 0.005 Gm. of residue.

Assay.—Dissolve about 0.3 to 0.4 Gm. of Calcium Carbonate, previously dried to constant weight at 200° C. (392° F.) and accurately weighed, in 10 mils of distilled water and 10 mils of diluted hydrochloric acid and boil the solution to expel all carbon dioxide. Transfer this solution to a 200-mil graduated flask, add 100 mils of tenth-normal oxalic acid V.S., render it alkaline with ammonia water, shake the mixture well and allow to stand for three hours at from 60° to 70° C. (140°—158° F.) or over night at room temperature. Cool the liquid if necessary, fill the flask with distilled water to the mark, mix it well, filter through a dry filter into a dry flask, reject the first 20 mils of the filtrate, and proceed as follows: Add diluted sulphuric acid to 100 mils of the filtrate (representing one-half of the Calcium Carbonate taken) until of acid reaction, then add 25 mils more of the diluted sulphuric acid, warm the solution to from 60° to 70° C. (140° to 158° F.), and titrate with tenth-normal potassium permanganate V.S. It shows, in the dried salt, not less than 98 per cent. of $CaCO_3$. Each mil of tenth-normal oxalic acid V.S. used corresponds to 0.0050035 Gm. of $CaCO_3$. Each gramme of dried Calcium Carbonate corresponds to not less than 195.9 mils of tenth-normal oxalic acid V.S.

U. S. P. Preparation.—Syrupus Calcii Lactophosphatis.

N. F. Preparations.—Elixir Calcii Lactophosphatis; Liquor Alumini Subacetatis; Liquor Phosphatum Acidus; Liquor Phosphatum Compositus; Pasta Zinci Mollis; Syrupus Calcii Iodidi; Unguentum Sulphuris Compositum.

Uses.—This form of calcium carbonate, known popularly as *precipitated chalk,* is largely used in tooth powders and similar preparations; it is inferior to the prepared chalk as an ingredient in chalk mixtures, because it does not possess the adhesive powers of the latter. Because of its crystalline character some dental authorities claim it is too abrasive for tooth powders and prefer prepared chalk, mixed with enough magnesium carbonate to give it the necessary lightness. Dose, fifteen grains (1 Gm.).

CRETA PRÆPARATA. U. S. Prepared Chalk
[**Cret. Præp.**—DROP CHALK

A native form of calcium carbonate freed from most of its impurities by elutriation and containing, when dried to constant weight at 200° C. (392° F.), not less than 97 per cent. of $CaCO_3$ (100.07).

Preparation.—The process formerly official is as follows:

Take of chalk a *convenient quantity.* Add a little water to the chalk, and rub it into fine powder. Throw this into a large vessel nearly full of water, stir briskly, and, after a short interval, decant the supernatant liquid, while yet turbid, into another vessel. Treat the coarser particles of the chalk, remaining in the first vessel, in a similar manner, and add the turbid liquid to that previously decanted. Lastly set the liquid aside, that the powder may subside, and, having poured off the water, dry the powder.

The object of this process is to effect the separation of the gritty particles in ordinary chalk by elutriation (see page 208). It is usual to form the moist powder into cones by trochiscation (see page 208).

While elutriation effects the purification of the chalk to a certain extent, it does not separate the insoluble fine particles, and hence prepared chalk is chemically not so pure as precipitated calcium carbonate.

Prepared chalk differs greatly in appearance from precipitated chalk, even after it has been reduced to a fine powder. It is usually not so white as the latter, and it adheres to the fingers when handled. This adhesiveness fits it for many purposes. *Whiting*, a cheap form of prepared chalk, is used for polishing.

Official Description.—A white to grayish-white, very fine, amorphous powder, often formed into "conical drops"; permanent in the air.

Odor, Taste, and Reaction.—Odorless and tasteless.

Solubility.—Prepared Chalk is almost insoluble in water; insoluble in alcohol; decomposed and dissolved by diluted acetic, hydrochloric, or nitric acid, with copious effervescence. When a weighed amount of Prepared Chalk is dissolved in diluted hydrochloric acid not more than 2 per cent. of residue remains.

Tests for Identity.—Dissolve about 0.1 Gm. of Prepared Chalk in 5 mils of diluted acetic acid and filter the solution; the addition of ammonium oxalate T.S. to the filtrate yields a white precipitate, insoluble in acetic acid but soluble in hydrochloric acid.

When heated to full redness, Prepared Chalk gradually loses carbon dioxide and is converted into calcium oxide.

Assay.—Proceed as directed under *Calcii Carbonas Præcipitatus.* It shows, in the dried salt, not less than 97 per cent. of $CaCO_3$. Each gramme of dried Prepared Chalk corresponds to not less than 193.9 mils of tenth-normal oxalic acid V.S.

U. S. P. Preparations.—Hydrargyrum cum Creta; Mistura Cretæ (from Compound Chalk Powder); Pulvis Cretæ Compositus.

N. F. Preparation.—Pulvis Cretæ Aromaticus.

Uses.—This is the form of chalk which is used in medicine almost exclusively; it is an antacid, and is admirably adapted for the treatment of diarrhœa. It is used in the compound chalk powder. Dose, fifteen grains (1 Gm.).

CALCII CHLORIDUM. U. S. Calcium Chloride
[Calc. Chlor.]

A hydrated form of Calcium Chloride containing not less than 75 per cent. of $CaCl_2$ (110.99). Preserve it in well-stoppered bottles.

Preparation.—Hydrated calcium chloride is obtained as a by-product of various industrial processes, such as the manufacture of ammonia water and ammonia soda, but may be prepared by saturating hydrochloric acid with chalk or marble, and carefully evaporating to dryness, at a temperature not exceeding 200° C. (392° F.), until it contains about 24 per cent. of water.

$$\underset{\text{Calcium Carbonate}}{CaCO_3} + \underset{\text{Hydrochloric Acid}}{2HCl} = \underset{\text{Calcium Chloride}}{CaCl_2} + \underset{\text{Carbon Dioxide}}{CO_2} + \underset{\text{Water}}{H_2O}$$

Official Description.—It occurs in white, slightly translucent, hard fragments, granules, or sticks; very deliquescent.

Odor, Taste, and Reaction.—Odorless, having a sharp, saline taste. Its aqueous solution (1 in 20) is neutral or slightly alkaline to litmus.

Solubility.—One Gm. of Calcium Chloride dissolves in 1.2 mil of water and in about 10 mils of alcohol at 25° C. (77° F.); also in 0.7 mil of boiling water and about 2 mils of boiling alcohol.

Tests for Identity.—An aqueous solution of the salt (1 in 20) yields, with ammonium oxalate T.S., a white precipitate insoluble in acetic acid, but soluble in hydrochloric acid.

Silver nitrate T.S. added to an aqueous solution of the salt (1 in 10) produces a white precipitate insoluble in nitric acid but readily soluble in ammonia water.

Impurities and Tests for Impurities.—*Iron, Aluminum, Phosphates, etc.*—Add ammonia water to an aqueous solution of the salt (1 in 20) until of alkaline reaction; no turbidity or precipitation occurs either before or after boiling.

Magnesium and Alkalies.—Precipitate the calcium completely from 10 mils of an aqueous solution of the salt (1 in 20) by adding ammonium oxalate T.S. and filtering. The filtrate on evaporation and ignition leaves not more than 0.004 Gm. of fixed residue.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Proceed as directed under the Assay for chlorides (see U. S. P., Test No. 5, Chapter LXII), using about 0.3 Gm. of Calcium Chloride, accurately weighed in a stoppered weighing-bottle. It shows not less then 75 per cent. of $CaCl_2$. Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.00555 Gm. of $CaCl_2$. Each gramme of Calcium Chloride corresponds to not less than 135.1 mils of tenth-normal silver nitrate V.S.

N. F. Preparation.—Liquor Hydrastinæ Compositus.

Uses.—It is administered as a hemostatic in doses of five to fifteen grains (0.32 to 1 Gm.) in both gastric and intestinal bleeding, usually in dilute solution or in *pills*. It is also applied locally in dilute solution to stop bleeding. It is incompatible with carbonates, phosphates, tartrates and sulphates. Fused calcium chloride is used in chemical processes for dehydrating gases; this it does through its powerful affinity for water.

CALCII GLYCEROPHOSPHAS. U. S. Calcium Glycerophosphate

[**Calc. Glycerophos.**—CALCIUM GLYCERINOPHOSPHATE]

The normal calcium salt of glycerophosphoric acid [$C_3H_5(OH)_2PO_4H_2 = 172.11$], containing, when dried to constant weight at 130° C. (266° F.), not less than 98 per cent. of $CaC_3H_7PO_6$ or $C_3H_5(OH)_2PO_4Ca$ (210.17). Preserve it in well-closed containers.

Preparation.—This salt is prepared by adding glycerophosphoric acid to an excess of milk of lime or calcium carbonate, filtering out the excess of calcium salt, removing any dissolved lime by the addition of carbon dioxide, concentrating in vacuum, and precipitating the glycerophosphate by the addition of alcohol.

Official Description.—It occurs as a fine white powder; somewhat hygroscopic.

Odor, Taste, and Reaction.—Odorless and almost tasteless. A saturated aqueous solution of the salt is alkaline to litmus and to phenolphthalein.

Solubility.—One Gm. of Calcium Glycerophosphate dissolves in about 50 mils of water at 25° C. (77° F.); soluble in less water at a lower temperature; citric acid increases its solubility; insoluble in alcohol.

Tests for Identity.—A cold, saturated aqueous solution of the salt yields white iridescent scales of anhydrous calcium glycerophosphate when heated to boiling.

When heated above 170° C. (338° F.), the salt is decomposed, evolving inflammable vapors, and at a red heat it is converted into calcium pyrophosphate.

A saturated aqueous solution of the salt yields with ammonium oxalate T.S. a white precipitate, insoluble in acetic acid but soluble in hydrochloric acid. With lead acetate T.S. the saturated solution yields a white curdy precipitate which is soluble in nitric acid.

Impurities and Tests for Impurities.—*Phosphates.*—Dissolve 1 Gm. of Calcium Glycerophosphate in 10 mils of diluted nitric acid and add an equal volume of cold ammonium molybdate T.S.; no precipitate is formed within one hour, but on heating the mixture a yellow precipitate is formed.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Chloride.—Dissolve 0.1 Gm. of the salt in 10 mils of diluted nitric acid and add 1 mil of silver nitrate T.S.; an opalescence but no precipitate may appear within one minute.

Sulphate.—Dissolve 0.1 Gm. of the salt in 10 mils of diluted hydrochloric acid and add 1 mil of barium chloride T.S.; no distinct turbidity appears within one minute.

Alcohol-soluble Impurities, etc.—Shake 1 Gm. of finely powdered Calcium Glycerophosphate with 25 mils of dehydrated alcohol, filter the mixture, evaporate the filtrate on a water bath and dry the residue for an hour at a temperature not exceeding 70° C. (158° F.). The resulting residue weighs not more than 0.01 Gm.

Water.—Dry a portion of the finely powdered salt to constant weight at 130° C. (266° F.); the loss does not exceed 10 per cent.

Assay.—Dissolve about 0.4 Gm. of the salt, previously dried to constant weight at 130° C. (266° F.), and accurately weighed, in 20 mils of a 5 per cent. solution of acetic acid and add 30 mils of distilled water. Heat the mixture to boiling and add an excess of ammonium oxalate T.S. Collect the resulting precipitate, wash, dry, and then ignite it until of constant weight. This residue of calcium oxide corresponds to not less than 26.1 per cent. of the weight of Calcium Glycerophosphate taken. Dry a portion of Calcium Glycerophosphate to constant weight at 130° C. (266° F.), and ignite it to constant weight; the weight of calcium pyrophosphate corresponds to not less than 59.2 per cent. of the weight of Calcium Glycerophosphate taken.

N. F. Preparations.—Elixir Calcii et Sodii Glycerophosphatum; Elixir Glycerophosphatum Compositum.

Uses.—It is used in doses of four to ten grains (0.25 to 0.65 Gm.) as a tonic and nervine and where calcium salts are indicated.

CALCII HYPOPHOSPHIS. U. S. Calcium Hypophosphite
[Calc. Hypophos.]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 98 per cent. of $Ca(PH_2O_2)_2$ (170.18). Preserve it in well-closed containers. Caution should be observed in dispensing Calcium Hypophosphite as an explosion is liable to occur when it is triturated or heated with nitrates, chlorates, or other oxidizing agents.

Preparation.—This salt is made by boiling milk of lime and phosphorus together until the spontaneously inflammable gas, hydrogen phosphide, ceases to be evolved; it is necessary to provide for the safe escape of this gas by conducting it by a hood into a powerful draught.

$$\underset{\text{Phosphorus}}{8P} + \underset{\substack{\text{Calcium}\\\text{Hydroxide}}}{3Ca(OH)_2} + \underset{\text{Water}}{6H_2O} = \underset{\substack{\text{Calcium}\\\text{Hypophosphite}}}{3Ca(PH_2O_2)_2} + \underset{\substack{\text{Hydrogen}\\\text{Phosphide}}}{2PH_3}$$

The liquid is filtered to separate the insoluble phosphate and residuary lime, then concentrated, and refiltered to separate the calcium carbonate formed by the action of the air on a little lime held in solution, and lastly evaporated till a pellicle appears; after which the salt may be allowed to crystallize by setting the liquid aside, or may be obtained in the granular form by continuing the heat, and stirring. The heat employed in evaporating the solution should not be above 85° C. (185° F.), for fear of explosions, several accidents having occurred through carelessness in this respect, even when the evaporation was conducted with a water bath.

Official Description.—It occurs as colorless, transparent, monoclinic prisms, as small lustrous scales, or as a white, crystalline powder; permanent in the air.

Odor, Taste, and Reaction.—Odorless, having a nauseous and bitter taste. Dissolve 1 Gm. of the salt in 20 mils of distilled water; it requires not more than 1 mil of tenth-normal potassium hydroxide V.S. to produce a pink color, phenolphthalein T.S. being used as indicator.

Solubility.—One Gm. of Calcium Hypophosphite is slowly soluble in 6.5 mils of water at 25° C. (77° F.); insoluble in alcohol.

Tests for Identity.—When heated the salt decrepitates and begins to decompose, giving off water and evolving spontaneously inflammable hydrogen phosphide, and on complete ignition leaving a residue of calcium pyrophosphate.

When an aqueous solution of the salt (1 in 20), acidulated with hydrochloric acid, is added, drop by drop with agitation, to an excess of mercuric chloride T.S., a white precipitate of mercurous chloride is formed. Upon the further addition of the solution of Calcium Hypophosphite the precipitate becomes gray from reduction to metallic mercury.

An aqueous solution of Calcium Hypophosphite (1 in 20) yields with ammonium oxalate T.S. a white precipitate, insoluble in acetic acid, but soluble in hydrochloric acid.

Impurities and Tests for Impurities.—*Phosphate.*—When 1 Gm. of the salt is dissolved in 20 mils of distilled water, not more than 0.005 Gm. of residue remains.

Sulphides, etc.—Mix 5 mils of an aqueous solution of the salt (1 in 10) in a test tube with 0.5 mil of diluted hydrochloric acid and heat on a water bath; no offensive odor develops within thirty minutes.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Pour 5 mils of an aqueous solution of the salt (1 in 25) into a beaker containing 3 mils of nitric acid, diluted with about 10 mils of distilled water, and evaporate it to dryness on a water bath. The residue meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Dissolve about 0.75 Gm. of Calcium Hypophosphite, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed, in 10 mils of distilled water, add 10 mils of nitric acid and evaporate to dryness on a water bath. Add 5 mils of nitric acid to the residue, again evaporate to dryness on a water bath and dissolve the residue in sufficient distilled water to measure 100 mils. Transfer 10 mils of this solution to a 100-mil graduated flask, add sodium hydroxide T.S. (free from chloride) until a slight, permanent precipitate is produced; then add 50 mils of tenth-normal silver nitrate V.S. and proceed as directed in the assay under *Sodii Phosphas.* When calculated to the amount originally taken it shows not less than 98 per cent. of $Ca(PH_2O_2)_2$. Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.002836 Gm. of $Ca(PH_2O_2)_2$. Each gramme of Calcium Hypophosphite, dried to constant weight, corresponds to not less than 345.5 mils of tenth-normal silver nitrate V.S.

U. S. P. Preparation.—Syrupus Hypophosphitum.

N. F. Preparations.—Elixir Calcii Hypophosphitis; Elixir Cinchonæ Alkaloidorum et Hypophosphitum; Elixir Hypophosphitum; Elixir Hypophosphitum et Ferri; Emulsum Olei Morrhuæ cum Hypophosphitibus; Liquor Hypophosphitum; Liquor Hypophosphitum Compositus; Syrupus Calcii et Sodii Hypophosphitum; Syrupus Calcii Hypophosphitis; Syrupus Hypophosphitum Compositus.

Uses.—Calcium hypophosphite is used pharmaceutically to prepare the other hypophosphites, hypophosphorous acid, and as an ingredient in the syrup and compound syrup of hypophosphites and other preparations. Medicinally, it is used in phthisis and other wasting diseases, and in cases of defective nerve nutrition. The dose is from five to thirty grains (0.32 to 2 Gm.).

CALCII LACTAS. U. S. Calcium Lactate
[Calc. Lact.]

The hydrated form of Calcium Lactate $[Ca(C_3H_5O_3)_2+5H_2O = 308.23]$. It contains, when dried to constant weight at 120° C. (248° F.), not less than 98 per cent. of $Ca(C_3H_5O_3)_2$ (218.15). Preserve it in well-closed containers.

Preparation.—It may be prepared by dissolving calcium carbonate in warm dilute lactic acid, filtering while hot and crystallizing. In the manufacture of lactic acid this salt is obtained as an intermediate product.

Official Description.—It occurs in white, granular masses or powder; it is somewhat efflorescent; at 120° C. (248° F.) it becomes anhydrous. When dried to a constant weight at that temperature the loss is not more than 29.2 per cent. (corresponding to 5 molecules of water of crystallization) nor less than 25 per cent.

Odor, Taste, and Reaction.—Odorless and nearly tasteless. An aqueous solution of Calcium Lactate (1 in 20) is neutral, slightly acid, or slightly alkaline to litmus, but is not reddened by phenolphthalein T.S.

Solubility.—One Gm. of Calcium Lactate dissolves in 20 mils of water at 25° C. (77° F.); almost insoluble in alcohol.

Tests for Identity.—Acidulate an aqueous solution of the salt (1 in 20) with sulphuric acid, add potassium permanganate and heat the mixture; the odor of acetaldehyde is developed. With ammonium oxalate T.S. an aqueous solution (1 in 20) yields a white precipitate, insoluble in acetic acid but soluble in hydrochloric acid.

Impurities and Tests for Impurities.—*Heavy Metals.*—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Magnesium and Alkalies.—Add ammonium oxalate T.S. to 20 mils of a hot aqueous solution of the salt (1 in 20) until no further precipitate is produced, filter the mixture after three hours, and wash the precipitate with 50 mils of distilled water. The combined filtrate and washings leave not more than 0.01 Gm. of residue on evaporation and subsequent ignition.

Fat Acids.—Stir about 0.5 Gm. of the salt with 1 mil of sulphuric acid: the mixture does not emit an odor of volatile fat-acids, even on warming.

Assay.—Incinerate in a crucible about 2 Gm. of the salt, previously dried to constant weight at 120° C. (248° F.) and accurately weighed, dissolve the residue in 50 mils of half-normal hydrochloric acid V.S. and titrate the excess of acid with half-normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows, in the dried salt, not less than 98 per cent. of $Ca(C_3H_5O_3)_2$. Each mil of half-normal hydrochloric acid V.S. used corresponds to 0.05454 Gm. of $Ca(C_3H_5O_3)_2$. Each gramme of dried Calcium Lactate corresponds to not less than 17.97 mils of half-normal hydrochloric acid V.S.

Uses.—It is used to control hemorrhage, as it increases the coagulability of the blood, being administered in doses of from five to ten grains (0.32 to 0.65 Gm.) three or four times a day. It is also used in chilblains and chronic ulcers and tuberculosis infections.

CALCII SULPHIDUM CRUDUM. U. S. Crude Calcium Sulphide

[**Calc. Sulphid. Crud.**—CALX SULPHURATA, U.S.P. VIII SULPHURATED LIME]

It contains not less than 55 per cent. of CaS (72.14). Preserve it in well-closed containers. It may be prepared by the U. S. P. VIII process, as follows:

	Metric	Old form
Exsiccated Calcium Sulphate, in fine powder	70 Gm.	7 oz. av.
Charcoal, in fine powder	10 Gm.	1 oz. av.
Starch	2 Gm.	87 gr.

Mix the powder thoroughly, pack the mixture lightly into a crucible, cover this loosely, and heat it to bright redness, until the contents have lost their black color. Allow the crucible to cool, reduce the product to powder, and at once transfer it to small, glass-stoppered vials.

This is not a definite chemical compound, but contains varying amounts of the active constituent, calcium sulphide. The reaction is as follows:

$CaSO_4$	+	C_3	=	CaS	+	CO_2	+	$2CO$
Calcium Sulphate		Charcoal or Carbon		Calcium Sulphide		Carbon Dioxide		Carbon Monoxide

Official Description.—A pale gray or yellowish powder; gradually decomposes on exposure to moist air.

Odor and Taste.—It has a faint odor of hydrogen sulphide and a nauseous and alkaline taste.

Solubility.—Crude Calcium Sulphide is very slightly soluble in cold water; more readily soluble in boiling water with partial decomposition; readily dissolved by solutions of ammonium salts; insoluble in alcohol.

Tests for Identity.—When Crude Calcium Sulphide is decomposed by diluted acetic acid, hydrogen sulphide is evolved and a residue of calcium sulphate and carbon frequently remains. The filtered solution yields with ammonium oxalate T.S. a white precipitate insoluble in acetic acid but soluble in hydrochloric acid.

Assay.—Introduce about 0.2 Gm. of Crude Calcium Sulphide, accurately weighed, into a glass-stoppered bottle or flask; add 50 mils of distilled water, mix, and quickly introduce 30 mils of a 10 per cent. ammonium chloride solution and immediately stopper the flask. Agitate the contents for a few minutes, add quickly 20 mils of a 10 per cent. cadmium chloride solution, immediately insert the stopper and again agitate well for a few minutes. Then add 5 mils of acetic acid, heat the mixture on a water bath for fifteen minutes, decant the supernatant liquid through a filter, agitate the remaining precipitate with 10 mils of diluted acetic acid, transfer the precipitate to the filter and wash with 10 mils of diluted acetic acid. Return the filter and precipitate to the original flask, add 50 mils of tenth-normal iodine V.S. and 20 mils of a mixture of equal volumes of hydrochloric acid and water. Stopper the flask and agitate it vigorously for a few minutes, and then titrate the excess of iodine with tenth-normal sodium thiosulphate V.S. It shows not less than 55 per cent. of CaS. Each mil of tenth-normal iodine V.S. used corresponds to 0.003607 Gm. of CaS. Each gramme of Crude Calcium Sulphide corresponds to not less than 152.5 mils of tenth-normal iodine V.S.

Uses.—Sulphurated lime is used as a depilatory for removing superfluous hair from the body, by mixing a small quantity with water and applying the paste to the part. It is used internally in acne and other skin diseases. The dose is one-half grain to one grain (0.03 to 0.065 Gm.).

LIQUOR HYPOPHOSPHITUM. N. F. Solution of Hypophosphites

[Liq. Hypophos.]

	Metric	Old form
Calcium Hypophosphite	35.0 Gm.	1 oz. av. 74 gr.
Sodium Hypophosphite	20.0 Gm.	292 gr.
Potassium Hypophosphite	17.5 Gm.	256 gr.
Hypophosphorous Acid	6.0 mils.	92 min.
Distilled Water, a sufficient quantity,		
To make	1000 mils.	2 pints

Dissolve the hypophosphites, with the aid of the acid, in sufficient distilled water to make the product measure 1000 mils [old form 2 pints] and filter.

Uses.—It is used as a tonic and nervine like the syrup of hypophosphites, but eliminates sugar, which is sometimes objectionable. The usual dose is one fluidrachm (4 mils).

LIQUOR HYPOPHOSPHITUM COMPOSITUS. N. F. Compound Solution of Hypophosphites

[Liq. Hypophos. Co.]

	Metric	Old form
Calcium Hypophosphite	8.500 Gm.	124 gr.
Potassium Hypophosphite	8.500 Gm.	124 gr.
Sodium Hypophosphite	2.200 Gm.	32 gr.
Ferric Hypophosphite	4.400 Gm.	64 gr.
Manganese Hypophosphite	2.200 Gm.	32 gr.
Quinine Hypophosphite	2.200 Gm.	32 gr.
Strychnine	0.065 Gm.	$\frac{95}{100}$ gr.
Potassium Citrate	8.500 Gm.	124 gr.
Hypophosphorous Acid	6.000 mils	92 min.
Orange Flower Water	35.000 mils	1 fl. oz. 58 min.
Glycerin	350.000 mils	11 fl. oz. 96 min.
Distilled Water, a sufficient quantity,		
To make	1000 mils	2 pints

Dissolve the calcium, sodium, and potassium hypophosphites in 300 mils [old form about 9½ fl. oz.] of distilled water. Dissolve the remaining salts in 250 mils [old form 8 fl. oz.] of distilled water with the aid of heat and add the hypophosphorous acid in which the strychnine has previously been dissolved. Mix the two solutions, add the orange flower water and glycerin, and sufficient distilled water to make the product measure 1000 mils [old form 2 pints], allow the mixture to stand twelve hours, and filter.

Uses.—The N. F. solutions of hypophosphites contain no sugar and therefore may be used when sugar is contraindicated. Its use is similar to other hypophosphites in doses of one fluidrachm (4 mils).

LIQUOR PHOSPHATUM ACIDUS. N. F. Acid Solution of Phosphates

[**Liq. Phos. Acid.**—Solution of Acid Phosphates]

	Metric	Old form
Precipitated Calcium Carbonate	**50 Gm.**	1 oz. av. 293 gr.
Magnesium Carbonate	**5 Gm.**	73 gr.
Phosphoric Acid	**120 mils**	3 fl. oz. 403 min.
Distilled Water, a sufficient quantity,		
To make	**1000 mils**	2 pints

Mix the phosphoric acid with 700 mils [old form about 22½ fl. oz.] of distilled water and dissolve the carbonates in this mixture. Then add sufficient distilled water to make the product measure 1000 mils [old form 2 pints] and filter.

It is used as a tonic and alterative, usually added to nutritive drinks. The dose is one fluidrachm (4 mils).

LIQUOR PHOSPHATUM COMPOSITUS. N. F. Compound Solution of Phosphates

[**Liq. Phos. Co.**]

	Metric	Old form
Precipitated Calcium Carbonate	**70 Gm.**	2 oz. av. 147 gr.
Ferric Phosphate	**35 Gm.**	1 oz. av. 74 gr.
Ammonium Phosphate	**35 Gm.**	1 oz. av. 74 gr.
Potassium Bicarbonate	**8 Gm.**	117 gr.
Sodium Bicarbonate	**8 Gm.**	117 gr.
Citric Acid	**164 Gm.**	5 oz. av. 207 gr.
Glycerin	**375 mils**	12 fl. oz.
Phosphoric Acid	**140 mils**	4 fl. oz. 230 min.
Orange Flower Water	**250 mils**	8 fl. oz.
Distilled Water, a sufficient quantity,		
To make	**1000 mils**	2 pints

Triturate the precipitated calcium carbonate with the potassium and sodium bicarbonates, citric acid, glycerin and orange flower water, and gradually add the phosphoric acid, stirring until solution has been effected. Dissolve the ferric phosphate and the ammonium phosphate in 300 mils [old form about 9½ fl. oz.] of hot distilled water, cool and add this solution to that previously prepared. Finally add sufficient distilled water to make the product measure 1000 mils [old form 2 pints], and filter.

This preparation was introduced to provide a relatively permanent solution of the phosphates for the extemporaneous preparation of the N. F. syrups which rapidly discolor, due to the caramelization of the sugar by the free acid.

N. F. Preparations.—Syrupus Phosphatum Compositus; Syrupus Phosphatum cum Quinina et Strychnina.

CALCII LACTOPHOSPHAS. N. F. Calcium Lactophosphate

[Calc. Lactophos.]

A mixture in variable proportions of calcium lactate, calcium acid lactate, and calcium acid phosphate.

Preparation.—It may be prepared by mixing 15 parts of calcium carbonate, 30 parts of lactic acid, 9.86 parts of phosphoric acid and 150 parts of distilled water, and evaporating to dryness in a warm place, avoiding the use of a water bath.

Official Description.—It occurs in white granules or as a white powder.

Odor and Reaction.—Without odor. Its aqueous solution (1 in 20) is acid to litmus.

Solubility.—It is soluble in water, almost insoluble in alcohol.

Tests for Identity.—The addition of ammonium oxalate T.S. to an aqueous solution of Calcium Lactophosphate produces a white precipitate insoluble in acetic acid but soluble in hydrochloric acid.

Add 10 mils of diluted sulphuric acid and 5 mils of potassium permanganate T.S. to 5 mils of an aqueous solution of Calcium Lactophosphate (1 in 20) and gently warm the mixture; the odor of acetaldehyde is evolved.

Add silver nitrate T.S. or ammonium molybdate T.S. to separate portions of an aqueous solution of Calcium Lactophosphate (1 in 20); a yellow precipitate is produced.

Impurities and Tests for Impurities.—*Readily Carbonizable Impurities.*—Mix 0.5 Gm. of Calcium Lactophosphate with 5 mils of sulphuric acid; not more than a slight coloration results within one minute.

Sulphate.—Ten mils of an aqueous solution of Calcium Lactophosphate (1 in 100), mixed with 1 mil of diluted hydrochloric acid, does not at once become turbid on the addition of a few drops of barium chloride T.S.

Chloride.—Ten mils of an aqueous solution of Calcium Lactophosphate (1 in 100), when mixed with a few drops of nitric acid, yields not more than an opalescence on the addition of a few drops of silver nitrate T.S.

Heavy Metals.—An aqueous solution of Calcium Lactophosphate does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Mix 0.2 Gm. of Calcium Lactophosphate with 1 Gm. of potassium nitrate, ignite the mixture cautiously in small portions at a time until the carbonaceous matter is all or nearly all burned off, then add to the residue 20 mils of diluted sulphuric acid and evaporate the mixture until fumes of sulphuric anhydride are evolved. The residue meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Magnesium.—Dissolve 1 Gm. of Calcium Lactophosphate and 2 Gm. of ammonium chloride in 75 mils of distilled water, heat the solution to boiling and add an excess of ammonium oxalate T.S. (about 20 mils). Allow the precipitate to subside completely, then filter and supersaturate the filtrate with ammonia water; not more than a slight turbidity is produced.

N. F. Preparation.—Emulsum Olei Morrhuæ cum Calcii Lactophosphate.

Uses.—It is used as a tonic and to supply calcium to the system, usually in the form of the official Syrup. The dose is five to ten grains (0.32 to 0.65 Gm.).

CALCII PHOSPHAS PRÆCIPITATUS. N. F. Precipitated Calcium Phosphate

(U. S. P. VIII)

[Calc. Phos. Præc.]

Calcium Phosphate [$Ca_3(PO_4)_2 = 310.29$] losing, when dried at 200° C. (392° F.), not more than 4 per cent. of moisture.

Preparation.—Take of bone, calcined to whiteness, and in fine powder, 4 oz. troy; hydrochloric acid, 8 oz. troy; ammonia water, 12 fl. oz., or a sufficient quantity; distilled water, a sufficient quantity. Macerate the bone in the acid, diluted with a pint of distilled water, until it is dissolved, and filter the solution. Add another pint of distilled water, and then, gradually, ammonia water, until the liquid acquires an alkaline reaction. Mix the precipitate obtained, while yet in the state of magma, with twice its bulk of boiling distilled water, and pour the whole upon a strainer. Wash the precipitate with boiling distilled water until the washings cease to be affected by a solution of nitrate of silver, acidulated with nitric acid. Lastly dry the precipitate with a gentle heat.

Calcium phosphate exists in calcined bone; it is soluble in hydrochloric acid, but is precipitated from its solution by ammonia water, ammonium chloride remaining in solution.

It may be prepared from calcium chloride and sodium phosphate in the presence of ammonia water at boiling temperature. The reaction is as follows:

$$\underset{\text{Calcium Chloride}}{3CaCl_2} + \underset{\text{Sodium Phosphate}}{2Na_2HPO_4} + \underset{\text{Ammonia Water}}{2NH_4OH} = \underset{\text{Calcium Phosphate}}{Ca_3(PO_4)_2} + \underset{\text{Sodium Chloride}}{2NaCl} + \underset{\text{Ammonium Chloride}}{2NH_4Cl} + \underset{\text{Water}}{2H_2O}$$

Official Description.—It occurs as a white, amorphous or micro-crystalline, bulky powder, permanent in the air. At an intense white heat the salt fuses without decomposition.

Odor and Taste.—Odorless and tasteless.

Solubility.—Almost insoluble in cold water; partly decomposed by boiling water; almost insoluble in acetic acid, except when freshly precipitated; easily dissolved by hydrochloric or nitric acid; insoluble in alcohol.

Tests for Identity.—When moistened with silver nitrate T.S., either before or after ignition, the salt acquires a yellow color (distinction from *acid calcium phosphate*, which, after ignition, when moistened with silver nitrate T.S., remains white).

Ammonium molybdate T.S. precipitates from the solution yellow ammonium phosphomolybdate; the reaction is accelerated by a gentle heat, not exceeding 65° C. (149° F.).

Impurities and Tests for Impurities.—*Carbonate.*—For applying tests of identity and of purity, prepare a solution by shaking 2 Gm. of Precipitated Calcium Phospate with 20 mils of distilled water, adding nitric acid, drop by drop, until solution is effected and then sufficient distilled water to make the liquid measure 40 mils. While making this solution, no effervescence occurs on adding the acid.

To a portion of this solution add a slight excess of ammonia water, then an excess of silver nitrate T.S. and afterwards acetic acid, drop by drop, until the excess of ammonia is neutralized; the color of the precipitate changes from white to yellow.

Chloride.—Add to five mils of the solution, acidulated with nitric acid, 0.5 mil of silver nitrate T.S.; not more than a slight turbidity is produced.

Barium.—Add to five mils of the solution, strongly acidulated with nitric acid, 1 mil of potassium sulphate T.S.; no turbidity appears within fifteen minutes.

Heavy Metals.—An aqueous solution of Precipitated Calcium Phosphate (1 in 50), obtained by shaking the salt with distilled water, adding hydrochloric acid, drop by drop, and heating until solution is effected, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Five mils of a solution of Precipitated Calcium Phosphate in diluted nitric acid (1 in 25), heated with 1 mil of sulphuric acid until fumes of sulphur trioxide appear, does not respond to the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

N. F. Preparations.—Emulsum Olei Morrhuæ cum Calcii Phosphate; Pulvis Antimonialis; Syrupus Calcii Hydrochlorophosphatis.

Uses.—Precipitated calcium phosphate, on account of its insolubility in water, was used in making medicated waters in preference to magnesium carbonate and other similar substances in the U. S. P. 1890, but has been replaced by purified talc in later revisions of the U. S. P. It is administered largely now in combination with lactic acid and phosphoric acid, for use in cases of defective nutrition, as in the official syrup and in the N. F. emulsion. The dose is from ten to thirty grains (0.65 to 2 Gm.).

LIQUOR CALCIS SULPHURATÆ. N. F. Solution of Sulphurated Lime

[**Liq. Calc. Sulphurat.**—Solution of Oxysulphuret of Calcium
Vleminckx' Solution Vleminckx' Lotion]

	Metric	Old form
Calcium Oxide	**165 Gm.**	5 oz. av. 222 gr.
Sublimed Sulphur	**250 Gm.**	8 oz. av. 151 gr.
Water, a sufficient quantity,		
To make about	**1000 mils**	2 pints

Slake the calcium oxide, mix it with the sulphur and add the mixture gradually to 1750 mils [old form 3½ pints] of boiling water. Boil this mixture, with frequent agitation, until it is reduced to 1000 mils [old form 2 pints], and maintain this volume, while boiling one hour, by the addition of water from time to time. Cool and strain the mixture, and having allowed the solution to become clear by standing in a stoppered bottle, decant the clear brown liquid, and preserve it in completely filled and well-stoppered bottles.

Uses.—Used externally in the treatment of itch, scabies and other skin diseases; it is usually diluted with an equal volume or more of water.

Barium. Ba.; 137.37

This element furnishes salts for use officially in making tests or test solutions. Barium dioxide was used in the process for making solution of hydrogen dioxide, official in the U. S. P. 1890, but as there is no longer an official process the salt has been omitted from the Pharmacopœia. The dioxide, however, is used in enormous quantities in the production of hydrogen dioxide and is now produced in the United States. *Barium* occurs abundantly as *heavy spar*, a sulphate, and as *witherite*, a carbonate. It is a malleable metal, having a yellowish-white luster, decomposing water, and gradually oxidizing in the air.

Tests for Salts of Barium

1. A soluble barium salt produces with sulphuric acid or a soluble sulphate a white precipitate of barium sulphate, which is entirely insoluble in all acids.
2. Barium causes a colorless flame to be colored green.
3. Alkaline carbonates produce white precipitates with soluble barium salts, insoluble in excess.

Official Test Solutions of Barium

Test solution of Barium Chloride	Used in testing for sulphates
Test solution of Barium Hydroxide	Known as *baryta water* and used in testing for sulphates
Test solution of Barium Nitrate	Used in testing for sulphates

Unofficial Salts of Barium

Barii Acetas, $Ba(C_2H_3O_2)_2+H_2O$ Barium Acetate	By decomposing barium carbonate with acetic acid, evaporating, then crystallizing
Barii Benzoas, $Ba(C_7H_5O_2)_2+2H_2O$ Barium Benzoate	By adding to a solution of barium carbonate benzoic acid until neutralized, then evaporating and crystallizing

Unofficial Salts of Barium—*Continued*

Barii Boras Barium Borate	By adding to a solution of barium carbonate a solution of sodium borate, collecting and drying the precipitate
Barii Bromidum, $BaBr_2 + 2H_2O$ Barium Bromide	By saturating baryta water with hydrobromic acid, evaporating, then crystallizing
Barii Carbonas, $BaCO_3$ Barium Carbonate	Witherite, a native mineral used as a source of many barium salts, or it may be made by adding ammonium carbonate and ammonia water to a solution of barium chloride, washing the precipitate, and drying
Barii Chloridum, $BaCl_2 + 2H_2O$ Barium Chloride (See U. S. P. Test Solution)	By dissolving barium carbonate in hydrochloric acid, evaporating, then crystallizing
Barii Chromas, $BaCrO_4$ Barium Chromate	By adding baryta water to a solution of potassium chromate, collecting and drying the precipitate
Barii Citras, $Ba_3(C_6H_5O_7)_2$ Barium Citrate	By adding citric acid to baryta water in excess, and collecting the precipitate
Barii Dioxidum, BaO_2 Barium Dioxide	By heating barium oxide to about 450° C. (842° F.)
Barii Hydroxidum, $Ba(OH)_2 + 8H_2O$ Barium Hydroxide (See U. S. P. Test Solution)	By treating barium monoxide with water
Barii Iodidum, $BaI_2 + 2H_2O$ Barium Iodide	By boiling a solution of iron iodide with excess of barium carbonate, filtering, and crystallizing
Barii Nitras, $Ba(NO_3)_2$ Barium Nitrate (See U. S. P. Test Solution)	By adding to a solution of barium chloride a solution of sodium nitrate, and collecting and drying the precipitate
Barii Oxalas, $BaC_2O_4 + 2H_2O$ Barium Oxalate	By adding a solution of oxalic acid to an excess of baryta water, and collecting the precipitate
Barii Sulphas, $BaSO_4$ Barium Sulphate	By adding to a solution of barium chloride, sulphuric acid, and collecting the precipitate. This salt is often administered to patients who are to undergo an X-ray examination. It is given in large doses, 4 ounces or more, usually mixed with milk. It is insoluble and therefore non-toxic and by coating the stomach or intestinal tract the securing of radiograph pictures is greatly facilitated. It is usually prescribed as "*Bar. Sulph.*" and has on several occasions been mistaken for *barium sulphide* which is a depilatory and dangerously poisonous, and fatal results have followed.
Barii Sulphidum, BaS Barium Sulphide	By heating barium sulphate mixed with coal, in a furnace. It is used as a depilatory and is poisonous

Strontium. Sr.; 87.63

Strontium enters into three official salts. It occurs in nature chiefly as sulphate and carbonate. It is a yellow metal, sp. gr. 2.5; malleable, but somewhat harder than lead. Its use in medicine is due to Laborde's demonstration in 1890 that its salts are not poisonous in ordinary doses, but, in certain cases, beneficial.

Tests for Salts of Strontium

1. A soluble strontium salt produces with alkaline carbonates or with soluble phosphates a white precipitate.
2. Strontium causes a colorless flame to be colored red.
3. Solution of calcium sulphate produces a white precipitate with soluble strontium salts. Slow precipitation is hastened by the addition of alcohol.

U. S. P. Strontium Salts

Strontii Bromidum Strontium Bromide	Made by dissolving strontium carbonate in hydrobromic acid
Strontii Iodidum Strontium Iodide	Made by evaporating a solution of strontium hydroxide in hydriodic acid
Strontii Salicylas Strontium Salicylate	Made by neutralizing salicylic acid with strontium carbonate

N. F. Strontium Salt

Strontii Carbonas Strontium Carbonate	Made by precipitating soluble strontium salts with sodium carbonate. It also occurs native as *strontianite*

Unofficial Strontium Salts

Strontii Chloridum, $SrCl_2$ Strontium Chloride	Made by treating strontianite (native carbonate) with hot hydrochloric acid
Strontii Chromas, $SrCrO_4$ Strontium Chromate	Made by precipitating a strong solution of chloride or nitrate with neutral potassium chromate
Strontii Hydroxidum, $Sr(OH)_2$ Strontium Hydroxide	Obtained by treating the oxide with water

Unofficial Strontium Salts—*Continued*

Strontii Lactas, $Sr(C_3H_5O_3)_2+3H_2O$ Strontium Lactate	Made by dissolving freshly precipitated strontium carbonate in lactic acid
Strontii Nitras, $Sr(NO_3)_2$ Strontium Nitrate	By treating the carbonate with diluted nitric acid, evaporating and crystallizing
Strontii Oxidum, SrO Strontium Oxide	Obtained by heating the nitrate to redness or igniting the carbonate
Strontii Sulphas, $SrSO_4$ Strontium Sulphate	Occurs native as celestine

STRONTII BROMIDUM. U. S. Strontium Bromide
[Stront. Brom.]

It contains not less than 98 per cent. of $SrBr_2+6H_2O$ (355.57). Preserve it in well-closed containers.

Preparation.—This salt may be made in several ways, but the simplest method is to dissolve strontium carbonate in hydrobromic acid and then evaporate and crystallize the salt from the solution.

Official Description.—It occurs as colorless, transparent, hexagonal crystals; the salt deliquesces in moist air but effloresces in very dry air.

Odor, Taste and Reaction.—Odorless, and having a bitter, saline taste. Its aqueous solution (1 in 20) is neutral to litmus.

Solubility.—One Gm. of Strontium Bromide dissolves in 0.35 mil of water at 25° C. (77° F.); soluble in alcohol; insoluble in ether.

Tests for Identity.—When quickly heated, the crystals at first melt, and at above 180° C. (356° F.) lose all of their water of crystallization.

To a non-luminous flame the salt communicates a crimson color.

Silver nitrate T.S. added to an aqueous solution of the salt (1 in 10) produces a yellowish-white precipitate, insoluble in nitric acid or in a moderate excess of ammonia water.

With calcium sulphate T.S. an aqueous solution of the salt (1 in 20) slowly forms a white precipitate of strontium sulphate, insoluble in dilute acids; the precipitation occurs more quickly with diluted sulphuric acid or a readily soluble sulphate.

Impurities and Tests for Impurities.—*Iodine.*—Add a few drops of ferric chloride T.S. and 1 mil of chloroform to 10 mils of an aqueous solution of the salt (1 in 20) and shake the mixture; the chloroform does not acquire a violet tint.

Bromate.—Drop 1 mil of diluted sulphuric acid upon about 1 Gm. of the powdered salt; no yellow color appears at once.

Barium.—Dissolve 1 Gm. of Strontium Bromide and 1 Gm. of sodium acetate in 5 mils of distilled water, and render the solution slightly acid by the addition of from 3 to 5 drops (or a sufficient quantity) of diluted acetic acid. The solution, upon the addition of 5 drops of potassium dichromate T.S. and agitation, does not become cloudy within three minutes.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Proceed as directed under the Assay for bromides (see U. S. P., Test No. 5, Chapter LXII), using about 0.8 Gm. of Strontium Bromide, accurately weighed. It shows not less than 98 per cent. of $SrBr_2+6H_2O$. Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.017778 Gm. of $SrBr_2+6H_2O$. Each gramme of Strontium Bromide corresponds to not less than 55.1 mils nor more than 56.6 mils of tenth-normal silver nitrate V.S.

Uses.—Strontium bromide is used in place of potassium and sodium bromides in epilepsy. Dose, fifteen to thirty grains (1 to 2 Gm.).

STRONTII IODIDUM. U. S. Strontium Iodide
[Stront. Iod.]

It contains not less than 99 per cent. of SrI_2+6H_2O (449.57). Preserve it in small, amber-colored, glass-stoppered bottles, carefully protected from light.

Preparation.—This salt may be made by evaporating a neutral solution of strontium hydroxide or carbonate in hydriodic acid and crystallizing.

Official Description.—It occurs as colorless, transparent, hexagonal plates, as a white, granular powder, or in crystalline crusts. It is deliquescent, and is colored yellow by exposure to air and light.

Odor, Taste, and Reaction.—Odorless, and having a bitter, saline taste. Its aqueous solution (1 in 20) is neutral or slightly alkaline to litmus.

Solubility.—One Gm. of Strontium Iodide dissolves in about 0.2 mil of water at 25° C. (77° F.); soluble in alcohol; slightly soluble in ether.

Tests for Identity.—When cautiously heated, the crystals melt and gradually lose their water of crystallization. At a red heat, the salt is decomposed, losing iodine and leaving a residue of strontium oxide.

To a non-luminous flame it imparts a crimson color.

When calcium sulphate T.S. is added to an aqueous solution (1 in 10) it slowly forms a white precipitate of strontium sulphate, insoluble in dilute acids; the precipitation occurs more quickly with diluted sulphuric acid or a readily soluble sulphate.

Add 1 mil of ferric chloride T.S. to 5 mils of an aqueous solution of the salt (1 in 20); iodine is liberated, which imparts a violet color to chloroform, when shaken with it.

Impurities and Tests for Impurities.—*Barium.*—Dissolve 1 Gm. of Strontium Iodide and 1 Gm. of sodium acetate in 5 mils of distilled water, and render the solution slightly acid by the addition of from 3 to 5 drops (or a sufficient quantity) of diluted acetic acid. The solution, upon the addition of five drops of potassium dichromate T.S. and agitation, does not become cloudy within three minutes.

Cyanide.—Gently heat 5 mils of an aqueous solution of the salt (1 in 10) with 1 drop of ferrous sulphate T.S., 1 drop of ferric chloride T.S., and 0.5 mil of potassium hydroxide T.S.; no blue color appears after acidulating the mixture with hydrochloric acid.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Chloride or Bromide.—Dissolve 0.3 Gm. of the salt in 5 mils of distilled water, add an excess of silver nitrate T.S. and a few drops of nitric acid; filter, digest the precipitate with 5 mils of ammonia water and filter. On saturating the filtrate with nitric acid, not more than a slight turbidity is produced.

Assay.—Proceed as directed under the Assay for iodides (see U. S. P., Test No. 5, Chapter LXII), using about 1 Gm. of Strontium Iodide, accurately weighed. It shows not less than 99 per cent. of SrI_2+6H_2O. Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.022478 Gm. of SrI_2+6H_2O. Each gramme of Strontium Iodide corresponds to not less than 44 mils of tenth-normal silver nitrate V.S.

Uses.—This salt is sometimes used instead of potassium iodide, as it is believed to be less irritating to the intestinal tract, or less depressing to the general nutrition. Its medicinal uses are similar to those of the other alkali iodides. Dose, five to twenty grains (0.32 to 1.3 Gm.).

STRONTII SALICYLAS. U. S. Strontium Salicylate
[Stront. Salicyl.]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99 per cent. of $Sr(C_7H_5O_3)_2+2H_2O$ (397.74). Preserve it in well-closed containers, protected from heat and light.

Preparation.—It may be made by decomposing strontium carbonate with a strong, hot solution of salicylic acid, filtering and crystallizing.

Official Description.—It occurs as a white, crystalline powder.

Odor and Taste.—Odorless, and having a somewhat sweet, saline taste.

Solubility.—One Gm. of Strontium Salicylate dissolves in 19 mils of water, and in 61 mils of alcohol at 25° C. (77° F.); also in 3.7 mils of boiling water and in 14 mils of boiling alcohol.

Tests for Identity.—When heated, the salt is decomposed, giving off inflammable vapors and an odor of phenol, and finally leaving a residue of strontium carbonate and carbon.

To a non-luminous flame it imparts a crimson color.

With calcium sulphate T.S. an aqueous solution of the salt (1 in 20) slowly forms a white precipitate of strontium sulphate, insoluble in dilute acids.

Add a few drops of ferric chloride T.S. to an excess of a concentrated aqueous solution of Strontium Salicylate; a dark red color and a precipitate are produced; in an aqueous solution of the salt (1 in 100) a deep violet-blue color is produced.

Diluted hydrochloric acid produces a voluminous, white precipitate of salicylic acid in a concentrated aqueous solution of the salt.

Impurities and Tests for Impurities.—An aqueous solution of the salt (1 in 30) is colorless.

Heavy Metals.—Add 1 mil of diluted sulphuric acid to 10 mils of an aqueous solution of Strontium Salicylate (1 in 50) and filter; the filtrate does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Barium.—Agitate 2 Gm. of Strontium Salicylate with 10 mils of diluted acetic acid, heat the mixture, cool and then filter. The filtrate, upon the addition of 5 drops of potassium dichromate T.S., does not become cloudy within three minutes.

Assay.—Introduce into a platinum crucible about 2 Gm. of Strontium Salicylate, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed, and thoroughly carbonize it at a temperature not exceeding red heat. Dissolve the residue in 30 mils of half-normal hydrochloric acid V.S., and submit it to residual titration with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows, in the dried salt, not less than 99 per cent. of $Sr(C_7H_5O_3)_2+2H_2O$. Each mil of half-normal hydrochloric acid V.S. used corresponds to 0.099435 Gm. of $Sr(C_7H_5O_3)_2+2H_2O$. Each gramme of Strontium Salicylate, previously dried, corresponds to not less than 9.96 mils of half-normal hydrochloric acid V.S.

Uses.—Strontium salicylate is used in place of sodium salicylate in doses of ten to fifteen grains (0.65 to 1 Gm.). Its uses are similar to those of the sodium salt.

STRONTII CARBONAS. N. F. Strontium Carbonate
[Stront. Carb.]

It contains, when dried to constant weight at 100° C. (212° F.), not less than 99 per cent. of $SrCO_3$ (147.62).

Preparation.—It occurs in nature as the mineral *strontianite*, $SrCO_3$, and may be prepared by precipitating any of the soluble strontium salts with sodium carbonate.

Official Description.—It occurs as a white powder.

Odor and Taste.—Odorless and tasteless.

Solubility.—It is insoluble in water; dissolved with effervescence by diluted hydrochloric, nitric, or acetic acid. The addition of diluted sulphuric acid to solutions of the salt in dilute acid produces a white precipitate.

Impurities and Tests for Impurities.—*Sulphate.*—One Gm. of the salt yields a clear, or not more than slightly turbid, solution with 10 mils of diluted hydrochloric acid.

Chloride.—A solution of 0.1 Gm. of the salt in 10 mils of distilled water made with the aid of nitric acid does not immediately become more than slightly opalescent on adding silver nitrate T.S.

Barium.—Dissolve 1 Gm. of Strontium Carbonate in distilled water with the aid of a slight excess of acetic acid, dilute to 100 mils and to 10 mils of this solution add 5 drops of potassium dichromate T.S.; no turbidity develops within five minutes.

Soluble Substances.—Shake 2 Gm. of the salt with 25 mils of distilled water, filter, evaporate the filtrate and dry the residue at 100° C. (212° F.); it weighs not more than 0.01 Gm.

Heavy Metals.—A solution of the salt in a slight excess of diluted hydrochloric acid does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dissolve about 1.5 Gm. of Strontium Carbonate, dried to constant weight at 100° C. (212° F.) and accurately weighed, in 30 mils of normal hydrochloric acid V.S. and titrate the excess of acid with normal sodium hydroxide V.S., using methyl orange T.S. as indicator. It shows in the dried salt not less than 99 per cent. of $SrCO_3$. Each mil of normal hydrochloric acid V.S. consumed is equivalent to 0.07381 Gm. of $SrCO_3$. Each gramme of Strontium Carbonate requires not less than 13.4 mils of normal hydrochloric acid V.S.

N. F. Preparation.—Elixir Formatum Compositum.

Uses.—Strontium carbonate is used principally for the production of the other salts of strontium. In the N. F. it is used to make the formate in the compound elixir of formates.

QUESTIONS ON MAGNESIUM, CALCIUM, BARIUM AND STRONTIUM

Magnesium—Give formula in symbols and molecular weight. (See page 798.)
How is it found?
What are the tests for the salts of magnesium?
Magnesium carbonate—Give formula in symbols and molecular weight. What is its source? How is it usually made?
What is the process of the British Pharmacopœia for making this salt?
How may light magnesium carbonate be prepared?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Soluble salts; calcium oxide; iron; heavy metals.
What is the dose and for what purpose is it used?
Magnesium oxide—Give formula in symbols and molecular weight. What are its common names?
How is it prepared?
What change takes place on exposure to air and moisture?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Soluble salts; carbonate; calcium oxide; iron; heavy metals.
How can an excess of water of hydration be detected?
For what is magnesium oxide used in medicine? and how is it best administered? Give the dose.
Heavy magnesium oxide—What is the present official Latin title for this substance?
What is its synonym?
How does it differ from light magnesia?
What is magnesia magma? Give the common synonym. How is it prepared officially? Describe other methods for its manufacture. Describe its appearance, and tests for impurities. What are its medicinal uses and the dose?
Magnesium sulphate—Give formula in symbols and molecular weight.
What is the common name or synonym?
How is this salt obtained in the United States?
How is it sometimes prepared in England?
How much water of crystallization does it contain?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Heavy metals; chloride; arsenic.
What is its medicinal use and dose?
Solution of magnesium citrate—Give Latin official name.
How is it prepared?
What modifications of the official process are advisable?
Describe several styles of bottles used for this solution. How may this preparation be sterilized?
What is the dose? How is it often preferably administered?
Magnesium chloride—How is it obtained? Give description and solubility.
What impurities may be present and how detected?
Effervescent solution of magnesium sulphate—How is it prepared? Give the uses and dose.
Calcium—Give symbol and atomic weight.
In what forms does calcium occur?
What are its physical properties?
What are the tests for salts of calcium?
Calcium oxide—Give formula in symbols and molecular weight.
What are the Latin official title and synonyms?
How is it obtained?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected? Carbonate; insoluble matter; volatile substances.
What are its uses?
Solution of calcium hydroxide—Give Latin official name. By what name or synonym is it commonly known?
How is it made? Why not use the undissolved residue repeatedly in its preparation?
How may the lime be preserved?
To what chemical change is the deterioration of lime due?

How much calcium hydroxide does it contain?
Give formula in symbols and molecular weight of calcium hydroxide.
Is lime more soluble in hot or in cold water?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurities of alkalies or their carbonates be detected? How may lime water be preserved against deterioration? What is the dose?
For what is lime water used medicinally?
Chlorinated lime—Give Latin official name.
Upon what does the activity of this compound depend?
Calcium bromide—Give formula in symbols and molecular weight.
By what processes may this preparation be made?
Explain the reaction which takes place between milk of lime and solution of ammonium bromide when mixed.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Iodide; chloride; iron; sulphate; magnesium; alkalies; heavy metals; barium; bromate.
What are its uses and the dose?
Precipitated calcium carbonate—Give the formerly official British process for making it.
How may the fineness of the powder be promoted?
In what process is this salt obtained as a by-product?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Heavy metals; soluble impurities. What are its uses and the dose?
Which is preferred for chalk mixtures—this, or prepared chalk, and why?
What is prepared chalk? By what synonym is this commonly known?
What is the process for making it (formerly official)?
What is the object of this process?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity and impurities.
For what is it used, and into what official preparation does it enter?
What is whiting, and for what is it used?
Calcium chloride—Give formula in symbols and molecular weight.
How may this salt be prepared?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Iron; aluminum; phosphates; magnesium; heavy metals; alkalies.
For what purpose is it used?
Calcium glycerophosphate—How is it prepared?
Describe appearance, odor, taste, reaction and identity tests.
What impurities are likely to be present and how detected?
What are its uses and dose?
Calcium hypophosphite—Give Latin name, formula in symbols, and molecular weight.
What precaution is it wise to observe in dispensing calcium hypophosphite?
How is this salt prepared?
What temperature should be employed in evaporating the solution?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Phosphate and sulphides; arsenic; heavy metals.
What are its uses and the dose?
Calcium lactate—What is its chemical formula? How prepared?
Describe appearance, odor, taste and tests for identity.
What are its solubilities?
Name likely impurities and the tests for detecting them.
What are its uses and the dose?
Crude calcium sulphide—What are the official Latin title and the synonyms?
How may it be prepared?
Describe its appearance, odor, taste, solubility and tests for identity.
What are its uses and the dose?
Solution of hypophosphites—How is it prepared? What are its uses and the dose?
Compound solution of hypophosphites—Name the constituents. How is it prepared? Why is potassium citrate used? What advantage has the solution over the compound syrup of hypophosphites?

Acid solution of phosphates—How is it prepared? What is its use and dose?
Compound solution of phosphates—How is it made? For what is it used?
Calcium lactophosphate—How is it prepared? Describe appearance, odor, tests for identity.
What impurities are likely to be present and how detected?
Precipitated calcium phosphate—How prepared? What is its source? Describe appearance, odor, taste, solubility, and tests for identity and purity. What are its uses and the dose?
Solution of sulphurated lime—Give the synonyms. How is it prepared? How is it used medicinally?
Barium—Give symbol and atomic weight.
What salts of barium are used officially, and for what?
How is it found in nature?
What are the tests for salts of barium?
Strontium—Give symbol and atomic weight.
What salts of strontium are used officially, and for what?
By what tests may strontium salts be recognized?
Strontium bromide—Give Latin name, formula in symbols and molecular weight.
How is this salt made?
Describe the appearance, characteristics and solubility.
Give the tests for identity.
How may the following impurities be detected?—Iodine; bromate; heavy metals; barium.
What is the dose and for what is it used?
Strontium iodide—Give Latin name, formula in symbols and molecular weight.
How may it be made?
How is it described? Give the solubilities and tests for identity.
How may the following impurities be detected?—Heavy metals; barium; cyanide; chloride; bromide.
Strontium salicylate—Give Latin title, formula in symbols and molecular weight.
How may it be prepared?
Describe odor, taste, appearance and solubility.
How may the following impurities be detected?—Heavy metals; barium.
For what is it used medicinally and in what dose?
Strontium carbonate—How is it prepared?
Describe appearance, odor, taste, solubility.
What impurities are likely to be present and how detected?
What are its most important uses?

CHAPTER XLIII

ZINC, ALUMINUM, CERIUM, AND CADMIUM

Zn; 65.37. Al; 27.1. Ce; 140.25. Cd; 112.40

These metals are grouped together on account of the similarity in some of their physical properties, rather than because of the chemical analogies existing between them.

ZINCUM. U. S. Zinc
[Zinc.]

It contains not less than 99 per cent. of Zn (65.37).

Note.—A zinc of special purity for the Arsenic test will be found among the reagents (see Chapter LXII).

Preparation.—Zinc is made by roasting *calamine*, or *smithsonite*, impure zinc carbonates, with charcoal, in powder, and collecting the zinc by distillation, the vapors being conducted into water, where the zinc is condensed. It is also obtained in large quantities from *zinc blende*, which is a zinc sulphide. In the melting process for treating this ore the sulphur dioxide which is produced is converted into sulphuric acid. Zinc is bivalent, and combines with oxygen, chlorine, and phosphorus, forming zinc oxide, chloride, and phosphide, and with numerous acids to form salts.

Tests for Zinc Salts

1. Ammonium sulphide, if added to a solution of a zinc salt containing an excess of alkaline hydroxide, produces a characteristic white precipitate of zinc sulphide.

2. The alkali hydroxides of either sodium, potassium, or ammonium produce white precipitates of zinc hydroxide, freely soluble in an excess of alkali.

3. Sodium and potassium carbonates yield white precipitates, insoluble in an excess. With ammonium carbonate a precipitate is formed which is readily redissolved by an excess of the reagent.

Official Description.—A bluish-white metal, showing a crystalline fracture. It occurs in the form of thin sheets, or in irregular, granulated pieces, or moulded into thin pencils, or in powder, and having a specific gravity ranging from 6.9 when it is cast to 7.2 after it is rolled.

Solubility.—It is dissolved by diluted sulphuric or hydrochloric acid with the evolution of hydrogen, usually leaving some insoluble residue.

Tests for Identity.—When heated above 100° C. (212° F.) and not above 150° C. (302° F.) the metal becomes malleable and ductile; above 200° C. (392° F.), it becomes sufficiently brittle to be powdered in an iron mortar; at from 412° to 415° C. (773.6° to 779° F.) it melts, and at 940° C. (1724° F.) it boils and may be readily distilled.

Impurities and Tests for Impurities.—*Sulphur.*—Add 1 Gm. of Zinc to 25 mils of diluted sulphuric acid; the liberated hydrogen does not have a disagreeable odor, nor does it color a strip of paper moistened with lead acetate T.S. or

Arsenic, Antimony, and Phosphorus.—With silver nitrate T.S. The filtered solution is colorless, and yields a white, gelatinous precipitate with potassium ferrocyanide T.S., and a white precipitate with ammonium sulphide T.S.

Assay.—Dissolve about 1 Gm. of Zinc, accurately weighed, in a slight excess of hydrochloric acid and add sufficient distilled water to make 100 mils. Dilute 10 mils of the clear solution with distilled water to make 100 mils, render it slightly alkaline with ammonia water and subsequently treat it as directed in the assay for *Zinci Acetas* (see page 833), for the determination of zinc oxide. The metal yields an amount of zinc oxide corresponding to not less than 99 per cent. of Zn. Each gramme of Zinc corresponds to not less than 1.232 Gm. of ZnO.

Zinc may also be assayed by the Electrolytic method (see U.S.P., Test No. 4, Chapter LXII).

U. S. P. Preparation.—Liquor Zinci Chloridi.

Uses.—Zinc is used in making hydrogen, in the arsenic tests of the U. S. P. and N. F., and in preparing the zinc salts.

Zinc and U. S. P. Zinc Salts

Official Name	Preparation
Zincum	Made by roasting the impure carbonate with charcoal and distilling also from the native sulphide
Zinci Acetas	By treating zinc carbonate with acetic acid
Carbonas Præcipitatus	By double decomposition of zinc sulphate and sodium carbonate
Chloridum	By evaporating the solution of zinc chloride
Oxidum	By calcining zinc carbonate
Phenolsulphonas	By mixing solutions of barium phenolsulphonate and zinc sulphate, evaporating the supernatant liquid, and collecting the crystals
Stearas	By mixing solutions of castile soap and zinc sulphate, collecting the precipitate, and drying
Sulphas	By acting on zinc with diluted sulphuric acid
Valeras	By double decomposition of zinc sulphate and sodium valerate

Unofficial Zinc Salts

Zinci Bromidum, $ZnBr_2$, U. S. P. VIII Zinc Bromide	By double decomposition of zinc sulphate and potassium bromide
Zinci Cyanidum, $Zn(CN)_2$ Zinc Cyanide	By adding hydrocyanic acid to a solution of zinc acetate and collecting the precipitate
Zinci Dioxidum, ZnO_2 Zinc Dioxide, Zinc Peroxide	Prepared by mixing solutions of barium or sodium dioxide and zinc sulphate, and washing and drying the precipitate at 100° C. (212° F.). It is used as a dressing for wounds
Zinci et Potassii Cyanidum, K_2ZnCN_4 Zinc and Potassium Cyanide	By dissolving zinc cyanide in a solution of pure potassium cyanide, filtering, concentrating, then crystallizing
Zinci Ferrocyanidum, $Zn_2FeCN_6+2H_2O$ Zinc Ferrocyanide	By making a solution of zinc sulphate and a solution of potassium ferrocyanide, mixing them, and collecting the precipitate
Zinci Iodidum, ZnI_2, U. S. P. VIII Zinc Iodide	By digesting zinc with iodine diffused in water
Zinci Lactas, $Zn(C_3H_5O_3)_2+3H_2O$ Zinc Lactate	Dissolving, by the aid of heat, zinc carbonate in diluted lactic acid, filtering and concentrating, then crystallizing
Zinci Permanganas, $Zn(MnO_4)_2+6H_2O$ Zinc Permanganate	By adding a solution of zinc sulphate to a solution of barium permanganate until all barium is precipitated as the sulphate. Nearly black, lustrous deliquescent crystals, soluble in 3 parts of water. It is astringent and antiseptic, used in urethritis as injection or douche in 1–4000 solutions
Zinci Phosphidum Zn_3P_2 Zinc Phosphide	By passing vapors of phosphorus over fused zinc in a current of dry hydrogen
Zinci Salicylas, $Zn(C_7H_5O_3)_2+3H_2O$ Zinc Salicylate	By heatinc salicylic acid with distilled water, gradually adding zinc oxide suspended in water, until no longer dissolved, filtering, and then crystallizing
Zinci Sulphidum, ZnS Zinc Sulphide	It is found native as zinc blend but requires purification. It may be prepared by precipitating any soluble zinc salt with ammonium sulphide
Zinci Tartras Zinc Tartrate	By mixing hot concentrated solutions of zinc sulphate and neutral potassium tartrate, collecting the precipitate, and drying it
Oleatum Zinci Oleate of Zinc. U. S. P. 1890	By sifting zinc oxide upon oleic acid and heating gently until dissolved

ZINCI ACETAS. U. S. Zinc Acetate

[Zinc. Acet.]

It contains not less than 83.16 per cent. nor more than 87.32 per cent. of anhydrous zinc acetate, corresponding to not less than 99.5 per cent. of the crystallized salt [$Zn(C_2H_3O_2)_2+2H_2O=219.45$]. Preserve it in well-closed containers.

Preparation.—This salt may be made by adding 2 parts of zinc oxide, to 8½ parts of acetic acid, and 5 parts of distilled water. Then digesting the mixture for half an hour, heating to the boiling point, filtering while hot, and crystallizing. Drain the crystals in a funnel, and dry them upon bibulous paper. An additional quantity of crystals may be obtained by evaporating the mother liquor to one-half, slightly acidulating with acetic acid, and crystallizing.

The reaction is expressed as follows:

$$\underset{\text{Zinc Oxide}}{ZnO} + \underset{\text{Acetic Acid}}{2HC_2H_3O_2} = \underset{\text{Zinc Acetate}}{Zn(C_2H_3O_2)_2} + \underset{\text{Water}}{H_2O}$$

Official Description.—It occurs as soft, white, six-sided, monoclinic plates, of a pearly luster. When exposed to the air, the salt gradually effloresces and loses some of its acid.

Odor, Taste, and Reaction.—Having a faintly acetous odor, and, in dilute solutions, an astringent, metallic taste. Its aqueous solution is neutral or slightly acid to litmus.

Solubility.—One Gm. of Zinc Acetate dissolves in 2.3 mils of water and in 30 mils of alcohol at 25° C. (77° F.); also in 1.6 mils of boiling water and about 1 mil of boiling alcohol.

Tests for Identity.—When heated, the salt is partially fused, losing water and acid. At a higher temperature it is decomposed, with evolution of inflammable and empyreumatic vapors, and leaving a residue consisting chiefly of zinc oxide.

An aqueous solution of the salt (1 in 20) yields a white, gelatinous precipitate with potassium ferrocyanide T.S. and a white precipitate with ammonium sulphide T.S.

Add 0.1 Gm. of the salt to 1 mil of sulphuric acid and 1 mil of alcohol and warm the mixture; ethyl acetate is formed, recognizable by its odor.

Ammonium carbonate T.S., when added in small portions to an aqueous solution of the salt (1 in 20), produces at first a white precipitate, which redissolves completely upon the addition of an excess of the reagent.

Impurities and Tests for Impurities.—*Heavy Metals.*—Ten mils of an aqueous solution of the salt (1 in 50), to which 1 mil of hydrochloric acid has been added, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of the salt meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Dissolve about 1 Gm. of Zinc Acetate, accurately weighed, in 100 mils of distilled water, render the solution slightly alkaline with ammonia water and warm it to 80° C. (176° F.). Completely precipitate the zinc as zinc sulphide by the addition of ammonium sulphide T.S. and warm the liquid on a water bath until the precipitate settles. Collect the latter on a filter, wash it with distilled water containing a few drops of ammonium sulphide T.S., then dissolve it in hot, dilute nitric acid (1 in 3), evaporate the solution to dryness in a tared platinum dish, ignite the residue and weigh it as zinc oxide. The amount of zinc oxide obtained corresponds to not less than 83.16 per cent. nor more than 87.32 per cent. of $Zn(C_2H_3O_2)_2$. Each gramme of Zinc Acetate corresponds to not less than 0.369 Gm. nor more than 0.387 Gm. of zinc oxide.

Zinc Acetate may also be assayed by the Electrolytic method (see U. S. P., Test No. 4, Chapter LXII).

Uses.—Zinc acetate is used principally as a local remedy, in eye washes, injections, etc. If used internally, the dose is two grains (0.13 Gm.).

ZINCI CARBONAS PRÆCIPITATUS. U. S. Precipitated Zinc Carbonate

[Zinc. Carb. Præc.]

Precipitated Zinc Carbonate is of somewhat variable chemical composition, corresponding to not less than 68 per cent. of ZnO (81.37).

Preparation.—This salt may be prepared as follows:

Zinc sulphate, 10 parts; sodium carbonate, 10½ parts; boiling distilled water, a sufficient quantity. Dissolve the sodium carbonate in 16 parts of water in a capacious porcelain vessel, and pour into it the zinc sulphate also dissolved in 16 parts of water, actively stirring. Boil the mixture for fifteen minutes after effervescence has ceased, and allow the precipitate to subside. Decant the supernatant liquor, wash the precipitate, by decantation, with boiling distilled water, until the washings are no longer precipitated by barium chloride. Collect the precipitate on muslin and dry it with a gentle heat.

$$\underset{\text{Sodium Carbonate}}{5Na_2CO_3} + \underset{\text{Zinc Sulphate}}{5ZnSO_4} + \underset{\text{Water}}{3H_2O} = \underset{\text{Zinc Carbonate}}{(ZnCO_3)_2 3Zn(OH)_2} + \underset{\text{Sodium Sulphate}}{5Na_2SO_4} + \underset{\text{Carbon Dioxide}}{3CO_2}$$

If cold solutions of zinc sulphate and sodium carbonate are mixed, neutral zinc carbonate is precipitated. This carbonate quickly decomposes, carbon dioxide being evolved, which, upon escaping, makes a portion of the precipitate soluble. This loss is prevented by conducting the precipitation at the boiling temperature, whereby the carbon dioxide is driven off as quickly as it is formed, and solution is thereby prevented.

Official Description.—It is an impalpable, white powder; permanent in the air.

Odor and Taste.—Without odor or taste.

Solubility.—Precipitated Zinc Carbonate is insoluble in water or in alcohol; completely dissolved by diluted acids with copious effervescence; soluble in ammonia water and in ammonium carbonate T.S.

Tests for Identity.—When strongly heated, the salt loses water and carbon dioxide, and leaves a residue, which is yellow while hot, but becomes white on cooling.

For making the following tests for identity, make a solution by adding 10 mils of diluted sulphuric acid and 10 mils of distilled water to 1.5 Gm. of Precipitated Zinc Carbonate, and, after effervescence has ceased, remove the undissolved excess by filtration.

In portions of this solution a white gelatinous precipitate is produced by potassium ferrocyanide T.S., and a white precipitate by ammonium sulphide T.S.

Another portion of this solution yields with ammonium carbonate T.S. a white precipitate, which redissolves completely in an excess of the reagent.

Impurities and Tests for Impurities.—*Heavy Metals.*—Ten mils of a solution of the salt (1 in 50) made with the aid of a slight excess of hydrochloric acid does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Alkali.—Mix 1 Gm. of the salt in a flask with 10 mils of boiling distilled water and add 2 drops of phenolphthalein T.S.; not more than 1 mil of tenth-normal hydrochloric acid V.S. is required to discharge any red color that may be produced.

Assay.—Digest about 2 Gm. of Precipitated Zinc Carbonate, accurately weighed, with 50 mils of normal sulphuric acid V.S. until solution is complete; then titrate the excess of sulphuric acid with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows not less than 68 per cent. of ZnO. Each mil of normal sulphuric acid V.S. used corresponds to 0.040685 Gm. of ZnO. Each gramme of Precipitated Zinc Carbonate corresponds to not less than 16.8 mils of normal sulphuric acid V.S.

U. S. P. Preparation.—Liquor Zinci Chloridi.

Uses.—Precipitated zinc carbonate is used principally in ointments, and is often used to replace the impure carbonate termed *calamine* which is now official in the N. F. (see page 841). It is sometimes dusted upon inflamed surfaces as an astringent and absorbent.

ZINCI CHLORIDUM. U. S. Zinc Chloride
[Zinc. Chlor.]

It contains not less than 95 per cent. of $ZnCl_2$ (136.29). Preserve it in small, glass-stoppered bottles.

Preparation.—Zinc chloride is easily prepared by digesting metallic zinc in hydrochloric acid and evaporating the solution to dryness; or, preferably, by evaporating the official solution of zinc chloride.

$$\underset{\text{Zinc}}{2Zn} + \underset{\text{Hydrochloric Acid}}{4HCl} = \underset{\text{Zinc Chloride}}{2ZnCl_2} + \underset{\text{Hydrogen}}{4H}$$

Official Description.—It occurs as a white, or nearly white, granular powder, or in porcelain-like masses, or moulded into pencils. It is very deliquescent.

Odor, Taste, and Reaction.—Odorless; *it is so intensely caustic as to make tasting dangerous,* unless the salt is dissolved in a large quantity of water. An aqueous solution of the salt (1 in 10) is acid to litmus.

Solubility.—One Gm. of Zinc Chloride dissolves in 0.25 mil of water, and in about 1.3 mils of alcohol at 25° C. (77° F.); freely soluble in glycerin.

Tests for Identity.—When heated to 115° C. (239° F.), Zinc Chloride fuses to a clear liquid. At a higher temperature it is partly volatilized in dense, white fumes, and partly decomposed, leaving a residue of zinc oxide.

An aqueous solution of the salt (1 in 20) yields a white, gelatinous precipitate with potassium ferrocyanide T.S. and a white precipitate with ammonium sulphide T.S.

With silver nitrate T.S. an aqueous solution of the salt (1 in 20) yields a white, curdy precipitate insoluble in nitric acid but readily soluble in ammonia water.

Impurities and Tests for Impurities.—*Oxychloride.*—Mix an aqueous solution of the salt (1 in 20) with an equal volume of alcohol; a single drop of hydrochloric acid is sufficient to render 10 mils of the mixture perfectly clear.

Completely precipitate the zinc from a solution of 1 Gm. of the salt in 50 mils of distilled water, by means of ammonium sulphide, filter, evaporate the filtrate, and gently ignite; not more than 0.004 Gm. of residue remains.

Heavy Metals.—Ten mils of an aqueous solution of the salt (1 in 50) to which 1 mil of diluted hydrochloric acid has been added does not respond to the Test for heavy metals (see U. S. P., Test No. 3. Chapter LXII).

Add ammonium carbonate T.S., in small portions, to an aqueous solution of Zinc Chloride (1 in 20); the precipitate produced is white, and redissolves completely in an excess of the reagent.

Ammonium Salts.—Add sufficient potassium hydroxide T.S. to 5 mils of an aqueous solution of the salt (1 in 10) to redissolve the precipitate which first forms, and then warm the solution; the odor of ammonia is not perceptible.

Sulphate.—Ten mils of an aqueous solution of the salt (1 in 20), acidulated with 1 mil of hydrochloric acid, is not rendered more than slightly turbid by the addition of 1 mil of barium chloride T.S.

Assay.—Proceed as directed under the Assay for chlorides (see U. S. P., Test No. 5, Chapter LXII), using about 0.3 Gm. of Zinc Chloride, accurately weighed, in a stoppered weighing-bottle. It shows not less than 95 per cent. of $ZnCl_2$. Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.0068145 Gm. of $ZnCl_2$. Each gramme of Zinc Chloride corresponds to not less than 139.4 mils of tenth-normal silver nitrate V. S.

Uses.—Zinc chloride in solution is used as an antiseptic and disinfectant (see Liquor Zinci Chloridi, below). Externally, mixed with flour and water, it is used as an escharotic.

LIQUOR ZINCI CHLORIDI. U. S. Solution of Zinc Chloride
[Liq. Zinc. Chlor.]

An aqueous solution containing not less than 48.5 per cent. nor more than 52 per cent. of $ZnCl_2$ (136.29).

	Metric	Old form
***Zinc,** granulated	**240 Gm.**	6 oz. av. 84 gr.
Hydrochloric Acid	**840 Gm.**	21 oz. av. 293 gr.
Nitric Acid	**12 Gm.**	135 gr.
Precipitated Zinc Carbonate	**12 Gm.**	135 gr.
Distilled Water, a sufficient quantity,		
To make about	**1000 Gm.**	1 pint

Add the hydrochloric acid gradually to the zinc and 250 mils [old form 4 fl. oz.] of distilled water contained in a glass or porcelain vessel, and allow the mixture to stand until the reaction ceases and the acid is saturated. Then pour off the liquid, add the nitric acid and heat the mixture at a temperature not exceeding 115° C. (239° F.), until a portion, when removed and cooled, solidifies. Allow it to cool, and dissolve the solidified mass in sufficient distilled water to make the product weigh 1000 Gm. [or measure, old form 1 pint]. Then add the precipitated zinc carbonate, agitate the mixture occasionally during twenty-four hours, and set it aside until it has become clear by subsidence. Separate the clear solution by decantation or by means of a siphon, and preserve it in tightly stoppered bottles.

When zinc is treated with hydrochloric acid, hydrogen is evolved and zinc chloride is produced.

$$\underset{\text{Zinc}}{2Zn} + \underset{\substack{\text{Hydrochloric}\\\text{Acid}}}{4HCl} = \underset{\substack{\text{Zinc}\\\text{Chloride}}}{2ZnCl_2} + \underset{\text{Hydrogen}}{4H}$$

Zinc is almost invariably contaminated with iron, and more or less ferrous chloride is present in the first solution. Nitric acid is added, and the solution is evaporated to dryness. The iron salt is thus oxidized, and it is then precipitated by the addition of zinc carbonate, the insoluble ferric hydroxide and carbonate, with any excess of zinc carbonate, being filtered out.

Official Description.—A clear, colorless, liquid.

Odor, Taste, and Reaction.—Odorless, having a very astringent, metallic taste, and an acid reaction.

Specific Gravity.—About 1.548 at 25° C. (77° F.).

Tests for Identity and Impurities.—It conforms to the identity and purity tests for an aqueous solution of the salt as given under *Zinci Chloridum*, when taken in proportionate amount.

Assay.—Transfer to a tared flask about 0.6 Gm. of Solution of Zinc Chloride, weigh accurately, and proceed as directed under the Assay for chlorides (see U. S. P., Test No. 5, Chapter LXII). It shows not less than 48.5 per cent. nor more than 52 per cent. of $ZnCl_2$. Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.0068145 Gm. of $ZnCl_2$. Each gramme of Solution of Zinc Chloride corresponds to not less than 71.2 mils nor more than 76.3 mils of tenth-normal silver nitrate V.S.

Uses.—This solution, sometimes called *Burnett's disinfecting fluid*, is used principally as an antiseptic and disinfectant. Among its advantages, absence of odor is one of the most prominent.

ZINCI OXIDUM. U. S. Zinc Oxide

[Zinc. Oxid.]

It contains, when freshly ignited, not less than 99 per cent. of ZnO (81.37).

Preparation.—Zinc oxide may be prepared by exposing precipitated zinc carbonate, in a shallow vessel, to a low red heat until the water and carbon dioxide are wholly expelled.

$$\underset{\text{Zinc Carbonate}}{2ZnCO_3.3Zn(OH)_2} = \underset{\substack{\text{Zinc}\\\text{Oxide}}}{5ZnO} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{2CO_2} + \underset{\text{Water}}{3H_2O}$$

Commercial zinc oxide is made on the large scale by heating calamine and coal, ground together, roasting in a furnace of peculiar construction, and separating the impurities by blowing the mixed vapors up a large tower, allowing the heavier particles to subside in the tower, and then by a powerful draught blowing the zinc oxide into a room containing muslin bags, where the oxide is deposited. It is also prepared by heating metallic zinc in earthenware retorts until the zinc vapor ignites, in contact with the air. The resulting oxide is then conducted into large chambers, where it is deposited.

This kind of zinc oxide will not usually conform to the official tests; it is generally very white and filled with hard lumps, which are difficult to reduce to powder. The official powder has a marked cream tint, and can be mixed with ointment so that a smooth preparation is easily made without trituration. (See Unguentum Zinci Oxidi.)

Official Description.—A very fine, amorphous, white or yellowish-white powder, free from gritty particles; it gradually absorbs carbon dioxide from the air.

Odor, Taste, and Reaction.—Without odor or taste.

Solubility.—Zinc Oxide is insoluble in water or in alcohol; it dissolves without effervescence in dilute acids, also in ammonia water and in ammonium carbonate T.S.

Tests for Identity.—When strongly heated, it assumes a yellow color, which disappears on cooling.

For making the following tests for identity, digest 1.3 Gm. of Zinc Oxide, with occasional agitation, in a mixture of 10 mils of diluted hydrochloric acid and 10 mils of distilled water until the solution is saturated, then remove the undissolved Zinc Oxide by filtration.

In portions of this filtrate a white, gelatinous precipitate is produced by potassium ferrocyanide T.S., and a white precipitate by ammonium sulphide T.S.

Impurities and Tests for Impurities.—*Heavy Metals.*—Ten mils of a solution of Zinc Oxide (1 in 50), made with the aid of a slight excess of hydrochloric acid, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Alkali.—Mix 1 Gm. of Zinc Oxide in a flask with 10 mils of boiling distilled water and add 2 drops of phenolphthalein T.S.; not more than 1 mil of tenth-normal hydrochloric acid V.S. is required to discharge any red color that may be produced.

Assay.—Digest about 1.5 Gm. of freshly ignited Zinc Oxide, accurately weighed, with 50 mils of normal sulphuric acid V.S. until solution is complete. Then titrate the excess of sulphuric acid with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows not less than 99 per cent. of ZnO. Each mil of normal sulphuric acid V.S. used corresponds to 0.040685 Gm. of ZnO. Each gramme of freshly ignited Zinc Oxide corresponds to not less than 24.3 mils of normal sulphuric acid V.S.

U. S. P. Preparation.—Unguentum Zinci Oxidi.

N. F. Preparations.—Glycerogelatinum Zinci Durum; Glycerogelatinum Zinci Molle; Mulla Zinci; Pasta Resorcinolis Fortior; Pasta Resorcinolis Mitis; Pasta Zinci; Pasta Zinci Mollis; Pasta Zinci Sulphurata; Unguentum Picis Compositum; Unguentum Resorcinolis Compositum.

Uses.—Zinc oxide is rarely used internally; externally, it is used as an exsiccant to inflamed surfaces, and it may be dusted on the part or used in the form of an ointment.

ZINCI PHENOLSULPHONAS. U. S. Zinc Phenolsulphonate

[**Zinc. Phenolsulph.**—ZINC SULPHOCARBOLATE]

It contains not less than 73.7 per cent. nor more than 77.4 per cent. of anhydrous zinc phenolsulphonate, corresponding to not less than 99.5 per cent. of the crystallized salt [$(C_6H_5O.SO_3)_2Zn+8H_2O=555.72$]. Preserve it in small, well-closed containers.

Preparation.—This salt is made by mixing solutions of barium phenolsulphonate and zinc sulphate; barium sulphate is precipitated, the solution is evaporated, and the crystals which separate are washed and dried.

Official Description.—It occurs as colorless, transparent, rhombic prisms or tabular crystals or in granular form. When exposed to the air the salt effloresces, and upon exposure to light and air may become slightly pink.

Odor, Taste, and Reaction.—Odorless, and having an astringent, metallic taste. Its aqueous solution (1 in 10) is acid to litmus.

Solubility.—One Gm. of Zinc Phenolsulphonate dissolves in 1.6 mils of water and in 1.8 mils of alcohol at 25° C. (77° F.); also in 0.4 mil of boiling water.

Tests for Identity.—When heated to 125° C. (257° F.), the salt loses all of its water of crystallization. At a higher temperature it chars, emitting inflammable vapors having the odor of phenol, and finally leaves an incombustible residue.

An aqueous solution of the salt (1 in 20) yields a white, gelatinous precipitate with potassium ferrocyanide T.S., and a white precipitate with ammonium sulphide T.S.

Ammonium carbonate T.S., when added in small portions to an aqueous solution of the salt (1 in 20), produces a white precipitate which redissolves completely upon the addition of an excess of the reagent.

A dilute solution of the salt (1 in 100) is colored pale violet by ferric chloride T.S.

Impurities and Tests for Impurities.—*Sulphate.*—The addition of a few drops of barium chloride T.S. to 10 mils of an aqueous solution of the salt (1 in 20), previously acidulated with 3 drops of hydrochloric acid, produces not more than a slight turbidity.

Heavy Metals.—Ten mils of an aqueous solution of the salt (1 in 50), to which 1 mil of diluted hydrochloric acid has been added, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of the salt meets the requirements of the test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Dissolve about 1 Gm. of Zinc Phenolsulphonate, accurately weighed, in 100 mils of distilled water and proceed as directed in the Assay under *Zinci Acetas.* The amount of zinc oxide obtained corresponds to not less than 73.7 per cent. nor more than 77.4 per cent. of $Zn(C_6H_5O_4S)_2$. Each gramme of Zinc Phenolsulphonate corresponds to not less than 0.146 Gm. nor more than 0.153 Gm. of ZnO.

Zinc Phenolsulphonate may also be assayed by the Electrolytic method (see U. S. P., Test No. 4, Chapter LXII).

Uses.—Zinc phenolsulphonate is used as an antiseptic astringent and stimulant. When used internally, it may be given in doses of two grains (0.13 Gm.).

ZINCI STEARAS. U. S. Zinc Stearate
[Zinc. Stear.]

A compound of zinc with stearic acid and small but variable proportions of palmitic acid, containing an amount of zinc corresponding to not less than 13 per cent. nor more than 15.5 per cent. of ZnO.

Preparation.—Dissolve 10.1 Gm. of monohydrated sodium carbonate in 1000 mils of distilled water, add 46.4 Gm. of stearic acid, heat the mixture until the reaction is complete, add 1000 mils of hot distilled water and adjust the temperature to 50° C. (122° F.). Then dissolve 17.9 Gm. of zinc acetate in 1250 mils of warm distilled water, adjust the temperature of the solution to 50° C. (122° F.) and pour this solution into the sodium stearate solution just prepared, stirring constantly. Collect the precipitate on a strainer, wash thoroughly, and dry.

Official Description.—A fine, white bulky powder.

Odor, Taste, and Reaction.—Tasteless and having a faint, characteristic odor. The salt is neutral to moistened litmus paper.

Solubility.—Zinc Stearate is insoluble in water, alcohol or ether.

Tests for Identity.—When heated, the salt fuses. At a higher temperature it is decomposed, giving off inflammable vapors and the odor of burning fat, and finally leaves a residue consisting chiefly of zinc oxide.

Heat 1 Gm. of Zinc Stearate with a mixture of 25 mils of distilled water and 5 mils of hydrochloric acid; stearic acid is liberated and floats as an oily layer on the surface of the liquid.

Impurities and Tests for Impurities.—*Alkalies and Alkali Earths.*—Boil 1 Gm. of Zinc Stearate with 25 mils of distilled water and 5 mils of hydrochloric acid, filter while hot and wash the filter with 25 mils of hot water. Render the filtrate alkaline with ammonia water, warm it to 80° C. (176° F.) and add ammonium sulphide T.S. in excess, filter, evaporate the filtrate to dryness, and ignite the residue. Dissolve this residue in 10 mils of hot distilled water, filter, again evaporate, ignite, and weigh; not more than 1 per cent. of residue remains.

The insoluble residue of fatty acids obtained in the preceding test, when well washed, melts at a temperature not below 56° C. (132.8° F.).

Assay.—Boil about 1 Gm. of Zinc Stearate, accurately weighed, with 50 mils of tenth-normal sulphuric acid V.S. for ten minutes and cool. Then titrate the excess of sulphuric acid with tenth-normal potassium hydroxide V.S., using methyl orange T.S. as indicator. It shows not less than 13 per cent. nor more than 15.5 per cent. of ZnO. Each mil of tenth-normal sulphuric acid V.S. used corresponds to 0.0040685 Gm. of ZnO. Each gramme of Zinc Stearate corresponds to not less than 32 mils nor more than 38.1 mils of tenth-normal sulphuric acid V.S.

N. F. Preparation.—Unguentum Zinci Stearatis.

Uses.—Zinc stearate is used in the official ointment of zinc stearate, and as a dusting powder in dermatologic practice.

ZINCI SULPHAS. U. S. Zinc Sulphate
[Zinc. Sulph.]

It contains not less than 55.86 per cent. nor more than 58.65 per cent. of anhydrous zinc sulphate, corresponding to not less than 99.5 per cent. of the crystallized salt [$ZnSO_4 + 7H_2O = 287.55$]. Preserve it in well-closed containers.

Preparation.—Zinc sulphate is made by acting on metallic zinc or zinc oxide, in excess, with diluted sulphuric acid, hydrogen being evolved; the resulting solution is freed from the contamination of iron by first passing chlorine into it, when ferric chloride is produced, and, upon the addition of zinc carbonate, decomposition takes place, ferric hydroxide separating as an insoluble precipitate, which is removed by filtration, and a small quantity of zinc chloride is formed, which, being very soluble, remains in the mother liquor after the crystallization of the sulphate.

$$\underset{\text{Zinc}}{2Zn} + \underset{\text{Sulphuric Acid}}{2H_2SO_4} + \underset{\text{Water}}{H_2O} = \underset{\text{Zinc Sulphate}}{2ZnSO_4} + \underset{\text{Hydrogen}}{4H} + \underset{\text{Water}}{H_2O}$$

Official Description.—It occurs as colorless, transparent, rhombic crystals, or as a granular, crystalline powder; it is efflorescent in dry air.

Odor, Taste, and Reaction.—Without odor, and having an astringent, metallic taste. Its aqueous solution (1 in 10) is acid to litmus.

Solubility.—One Gm. of Zinc Sulphate dissolves in 0.6 mil of water, and in 2.5 mils of glycerin at 25° C. (77° F.); insoluble in alcohol.

Tests for Identity.—When rapidly heated, the salt melts. When strongly ignited, it is partly decomposed, losing both water and sulphuric acid.

An aqueous solution of the salt (1 in 20) yields a white, gelatinous precipitate with potassium ferrocyanide T.S., and a white precipitate with ammonium sulphide T.S. and with barium chloride T.S.

An aqueous solution of the salt (1 in 10) yields with ammonium carbonate T.S. a white precipitate, which redissolves completely in an excess of the reagent.

Impurities and Tests for Impurities.—*Heavy Metals.*—Ten mils of an aqueous solution of Zinc Sulphate (1 in 50), after being acidulated with 1 mil of diluted hydrochloric acid, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of the salt meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Free Acid.—An aqueous solution of Zinc Sulphate (1 in 20) is not colored pink by methyl orange T.S.

Chloride.—Add 2 drops of nitric acid to a solution of 1 Gm. of Zinc Sulphate in 20 mils of distilled water, follow with 0.2 mil of tenth-normal silver nitrate V.S. and filter the mixture. The subsequent addition of a few drops of tenth-normal silver nitrate V.S. to the filtrate produces no cloudiness or opalescence.

Alkali and Alkali Earth Salts.—Dissolve 1 Gm. of Zinc Sulphate in 50 mils of distilled water, precipitate the zinc completely with ammonium sulphide T.S., filter, evaporate the filtrate to dryness, and ignite; not more than 0.5 per cent. of residue remains.

Assay.—Dissolve about 1 Gm. of Zinc Sulphate, accurately weighed, in 100 mils of distilled water and estimate the salt as zinc oxide by the method given in the Assay under *Zinci Acetas.* The salt yields an amount of zinc oxide corresponding to not less than 55.86 per cent. nor more than 58.65 per cent. of $ZnSO_4$. Each gramme of Zinc Sulphate corresponds to not less than 0.2815 Gm. nor more than 0.2955 Gm. of ZnO.

Zinc Sulphate may also be assayed by the Electrolytic method (see U. S. P., Test No. 4, Chapter LXII).

N. F. Preparations.—Liquor Zinci et Alumini Compositus; Liquor Zinci et Ferri Compositus; Mistura Adstringens; Pulvis Antisepticus.

Uses.—This salt is the most important of those made from zinc. It is used medicinally as a prompt and certain emetic in doses of ten to thirty grains (0.6 to 2 Gm.); as a tonic and astringent, one to two grains (0.065 to 0.13 Gm.).

ZINCI VALERAS. U. S. Zinc Valerate

[**Zinc. Valer.**—ZINC VALERIANATE]

It contains not less than 99 per cent. of the crystallized salt [$Zn(C_5H_9O_2)_2+2H_2O=303.55$]. Preserve it in small, well-closed containers.

Preparation.—The process for making this salt affords an illustration of the rather rare instance of "upward precipitation," the crystals of zinc valerate being lighter than the mixed solutions.

"Take of sodium valerate, 5 oz. av.; zinc sulphate, 5½ oz. av.; distilled water, a sufficient quantity. Dissolve the salts separately, each in 35 fluidounces of distilled water, and, having heated the solutions to 100° C. (212° F.), mix them, and set the mixture aside to crystallize. Decant the mother water from the crystals, and put them upon a filter in a funnel to drain. Mix the mother water and the drainings, evaporate at a heat not exceeding 93.3° C. (200° F.) to 8 fluidounces, and again set aside to crystallize. Add the crystals, thus obtained, to those in the funnel, wash the whole with a little distilled water, and, having removed them with the filter, spread them on bibulous paper, and dry them with a heat not exceeding 93.3° C. (200° F.)."

$$\underset{\text{Sodium Valerate}}{2NaC_5H_9O_2} + \underset{\text{Zinc Sulphate}}{ZnSO_4} = \underset{\text{Zinc Valerate}}{Zn(C_5H_9O_2)_2} + \underset{\text{Sodium Sulphate}}{Na_2SO_4}$$

Official Description.—It occurs as white, pearly scales, or as a white powder. On exposure to the air, it slowly loses valeric acid and becomes partially insoluble in water.

Odor, Taste, and Reaction.—Having the odor of valeric acid, and a sweetish, astringent, and metallic taste. Its aqueous solution (1 in 100) is acid to litmus.

Solubility.—One Gm. of Zinc Valerate dissolves in 70 mils of water at 25° C. (77° F.), usually leaving an insoluble residue of basic salt; soluble in 22 mils of alcohol at 25° C. (77° F.).

Tests for Identity.—When gently heated, the salt melts. At a higher temperature it is decomposed, giving off inflammable vapors, and finally leaving a residue consisting chiefly of zinc oxide.

Dissolve 0.5 Gm. of Zinc Valerate in a mixture of 0.5 mil of hydrochloric acid and 9 mils of distilled water; the valeric (isovaleric) acid is liberated and floats as an oily layer on the surface of the liquid.

Zinc Valerate dissolves in ammonium carbonate T.S. without leaving a residue.

Impurities and Tests for Impurities.—*Heavy Metals.*—Filter the mixture just prepared through a small, wetted filter; the clear filtrate diluted with distilled water to 25 mils does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Heat 0.5 Gm. of Zinc Valerate with a mixture of 7.5 mils of distilled water and 5 mils of diluted sulphuric acid and filter; 5 mils of the filtrate meets the requirements for the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Acetate.—Triturate 0.5 Gm. of Zinc Valerate with 3 mils of distilled water and 0.2 mil of ferric chloride T.S., and filter. The filtrate does not show a red color.

Butyrate.—Add a concentrated, aqueous solution of copper acetate to a concentrated aqueous solution of Zinc Valerate; the mixture remains perfectly clear.

Assay.—Dissolve about 1 Gm. of Zinc Valerate, accurately weighed, in 100 mils of distilled water, with the aid of a few drops of hydrochloric acid, if necessary, and estimate the zinc as zinc oxide by the method given in the Assay under *Zinci Acetas.* The salt yields an amount of zinc oxide corresponding to not less than 99 per cent. of $Zn(C_5H_9O_2)_2+2H_2O$. Each gramme of Zinc Valerate corresponds to not less than 0.265 Gm. of ZnO.

Zinc Valerate may also be assayed by the Electrolytic method (see U. S. P., Test No. 4, Chapter LXII).

N. F. Preparation.—Elixir Zinci Valeratis.

Uses.—Zinc valerate is used as a nervine and antispasmodic, in doses of one to three grains (0.065 to 0.2 Gm.).

CALAMINA PRÆPARATA. N. F. Prepared Calamine

[**Calamin. Præp.**—Lapis Calaminaris]

Native zinc carbonate containing a varying amount of zinc silicate, calcined at a moderate temperature; or calcined zinc carbonate containing a small amount of ferric oxide.

Preparation.—The native zinc carbonate is calcined in covered earthen crucibles, then powdered and freed from gritty particles by elutriation. The pinkish color is due to the presence of iron. *Artificial calamine* has been found on the market prepared by mixing zinc carbonate, zinc oxide, and ferric oxide or by coloring talc or other insoluble substances with ferric hydroxide.

Official Description.—It is a pink powder, readily passing through a number 100 sieve.

Solubility.—Insoluble in water, but mostly dissolved by hydrochloric acid.

Tests for Identity and Impurities.—Digest 1 Gm. of Prepared Calamine for one hour on a water bath with 25 mils of diluted hydrochloric acid, adding distilled water to replace that lost through evaporation, filter the liquid and dilute the filtrate with distilled water to 100 mils. Portions of 10 mils each of this diluted filtrate conform to the following tests:

Lead.—No precipitate forms within ten minutes on adding potassium iodide T.S.

Presence of Zinc.—Boil a portion with a few drops of nitric acid, then with an excess of ammonia water and filter; it yields an abundant white precipitate with hydrogen sulphide T.S. An excess of hydrochloric acid added to another portion, followed by potassium ferrocyanide T.S., produces an abundant white or bluish-white precipitate.

Calcium.—Dilute a portion of the above solution with four parts of distilled water, slightly acidulate with acetic acid, and add ammonium oxalate T.S.; it shows not more than a slight turbidity.

Soluble Barium Salts.—Slightly acidulate a portion with hydrochloric acid, and add 2 mils of potassium sulphate T.S.; not more than a slight turbidity shows at once.

Barium Sulphate.—Fuse the residue, which remains after preparing the solution for the preceding tests, with sodium carbonate, treat the mass with hot distilled water, filter and wash. Then dissolve the residue in diluted hydrochloric acid and dilute to 20 mils. Ten mils of this solution does not become turbid upon the addition of 5 mils of potassium sulphate T.S.

N. F. Preparation.—Unguentum Calaminæ.

Uses.—Its uses are similar to those for zinc carbonate, being employed chiefly in protective ointments and lotions.

LIQUOR ZINCI ET ALUMINI COMPOSITUS. N. F. Compound Solution of Zinc and Aluminum

[**Liq. Zinc. et Alumin. Co.**]

	Metric	Old form
Zinc Sulphate	**200.0 Gm.**	6 oz. av. 296 gr.
Aluminum Sulphate	**200.0 Gm.**	6 oz. av. 296 gr.
Betanaphthol	**0.6 Gm.**	8½ gr.
Oil of Thyme	**2.0 mils**	31 min.
Water, a sufficient quantity,		
To make	**1000 mils**	2 pints

Dissolve the zinc sulphate and the aluminum sulphate in 800 mils [old form about 25½ fl. oz.] of water, by the aid of heat, add the betanaphthol and oil of thyme, and shake the mixture occasionally, in a stoppered bottle, until it is cold. Add sufficient water to make the product measure 1000 mils [old form 2 pints], mix well, set it aside for two days, and then filter the solution through a wetted filter.

Uses.—This solution and the following are used as disinfectant and deodorant solutions for general household use. They are not actively poisonous.

LIQUOR ZINCI ET FERRI COMPOSITUS. N. F. Compound Solution of Zinc and Iron

[**Liq. Zinc. et Ferr. Co.**—DEODORANT SOLUTION]

	Metric	Old form
Zinc Sulphate	200.0 Gm.	6 oz. av. 296 gr.
Ferrous Sulphate	200.0 Gm.	6 oz. av. 296 gr.
Copper Sulphate	65.0 Gm.	2 oz. av. 74 gr.
Betanaphthol	0.6 Gm.	8½ gr.
Oil of Thyme	2.0 mils	31 min.
Hypophosphorous Acid	4.0 mils	61 min.
Water, a sufficient quantity,		
To make	1000 mils	2 pints

Dissolve the zinc sulphate, ferrous sulphate, and copper sulphate in 800 mils [old form about 25½ fl. oz.] of boiling water, add the betanaphthol, and oil of thyme, and shake the mixture occasionally, in a stoppered bottle, until it is cold. Then add the hypophosphorous acid and sufficient water to make the product measure 1000 mils [old form 2 pints] and filter.

Aluminum. Al; 27.1

This metal is found largely in combination with silicic acid, in the rocks and clays forming a great portion of the earth's surface. Some of the precious stones and valuable minerals are compounds of aluminum; the ruby and sapphire, corundum and emery, are crystallized forms of aluminum oxide. Aluminum is of a silver-white color. The metal, owing to improvements in its extraction, is much cheaper than it was formerly, and is extensively used in making ornamental and useful articles and, when suitably alloyed, forms light metals of great strength which are being cast into engines and other large machines. Owing to its very low specific gravity (2.64 to 2.70), it is used for grain weights, because they are much larger, and thus more easily handled, than they would be if made from brass (see page 73). Aluminum forms but one class of compounds used in medicine; it is trivalent. The oxides and sulphates unite with those of the alkali metals and form double salts, called alums.

Tests for Salts of Aluminum

1. Potassium or sodium hydroxide produces white, gelatinous precipitates of aluminum hydroxide in solutions of alum, which are freely soluble in excess of the alkali.
2. Ammonia water produces a similar precipitate, insoluble in excess.
3. The alkaline carbonates precipitate the hydroxide, carbon dioxide being evolved.
4. Ammonium sulphide also precipitates the hydroxide, hydrogen sulphide being evolved.

U. S. P. Salts of Aluminum

Official Name	Preparation
Alumen	By treating alum clay with sulphuric acid and potassium sulphate
Exsiccatum	By heating alum to a temperature of 205° C. (401° F.)
Alumini Hydroxidum	By double decomposition of alum and sodium carbonate

N. F. Salts and Preparations of Aluminum

Official Name	Preparation
Alumini Chloridum	By acting on a solution of aluminum sulphate with barium chloride, filtering, concentrating the filtrate and crystallizing
Alumini Sulphas	By treating aluminum hydroxide with sulphuric acid and crystallizing
Liquor Alumini Acetatis	See page 846
Liquor Alumini Aceticotartratis	See page 846
Liquor Alumini Subacetatis	See page 847

Unofficial Salts of Aluminum

Alumini Acetas, $Al(C_2H_3O_2)_3$ Aluminum Acetate	By dissolving aluminum hydroxide in cold acetic acid, filtering and concentrating, then crystallizing
Alumini Bromidum, $AlBr_3$ Aluminum Bromide	By passing the vapor of bromine over a heated mixture of aluminum oxide and carbon
Alumini Iodidum, AlI_3 Aluminum Iodide	By heating aluminum and iodine together in closed tubes and collecting the crystals
Alumini Nitras, $Al(NO_3)_3+9H_2O$ Aluminum Nitrate	By dissolving aluminum hydroxide in nitric acid, filtering and concentrating, then crystallizing
Alumini Oxidum, Al_2O_3 Aluminum Oxide	Occurs in nature
Alumini Phosphas, $AlPO_4$ Aluminum Phosphate	By adding a neutral solution of aluminum hydroxide to a solution of sodium phosphate, and collecting the gelatinous precipitate

ALUMEN. U. S. Alum.
[Alum.]

It contains not less than 99.5 per cent. of $AlNH_4(SO_4)_2+12H_2O$ (453.47), or of $AlK(SO_4)_2+12H_2O$ (474.53), the label of the container must indicate whether the salt is Ammonium Alum or Potassium Alum.

Preparation.—This valuable salt is made from alum clay, which is chiefly aluminum silicate, but contains iron pyrites, which on calcination furnishes the sulphuric acid to combine with the alumina of the clay to form aluminum sulphate. It is also prepared on a large scale from aluminum hydroxide, which is a by-product in the cryolite process for making sodium carbonate. Potassium or ammonium sulphate or chloride is then added, when the double salt $AlK(SO_4)_2$ or $AlNH_4(SO_4)_2$ is produced. Both salts crystallize with twelve molecules of water. Ammonium alum, $AlNH_4(SO_4)_2$, is generally found in the market, because of its greater cheapness. Soda alum has been prepared, but is too hygroscopic for general use.

Official Description.—Ammonium Alum and Potassium Alum both occur in large, colorless crystals, crystalline fragments, or as white powders.

Odor, Taste, and Reaction.—Alum is odorless and has a sweetish and strongly astringent taste. An aqueous solution of Alum (1 in 20) is acid to litmus.

Solubility.—*Ammonium Alum.*—It is somewhat less soluble in water than is Potassium Alum.

Tests for Identity.—Potassium hydroxide T.S. added to an aqueous solution of Ammonium Alum (1 in 20) at first causes a precipitate, which completely dissolves in an excess of the reagent, ammonia being evolved.

Completely precipitate the aluminum from a boiling solution of 1 Gm. of Ammonium Alum in 100 mils of distilled water by the addition of a slight excess of ammonia water and filter; not more than 0.5 per cent. of residue remains on evaporating the filtrate to dryness and igniting it.

Solubility.—*Potassium Alum.*—One Gm. of Potassium Alum dissolves in 7.2 mils of water at 25° C. (77° F.) and in 0.3 mil of boiling water; insoluble in alcohol, freely soluble in glycerin.

Tests for Identity.—Potassium Alum imparts a violet color to a non-luminous flame. The addition of sodium bitartrate T.S. to a saturated solution of Potassium Alum produces, sometimes slowly, a white crystalline precipitate.

Potassium hydroxide T.S. added to an aqueous solution of Potassium Alum (1 in 20) at first causes a precipitate, which completely dissolves in an excess of the reagent, but no ammonia is evolved.

Both Ammonium Alum and Potassium Alum conform to the following tests:

Tests for Identity.—When heated it fuses, and at about 200° C. (392° F.) it loses all of its water of crystallization. When strongly heated it loses sulphuric anhydride, becoming incompletely soluble in water.

An aqueous solution of Alum (1 in 20) yields with ammonia water a white gelatinous precipitate almost insoluble in an excess of ammonia water.

With barium chloride T.S., an aqueous solution of Alum (1 in 20) yields a white precipitate insoluble in hydrochloric acid.

Impurities and Tests for Impurities.—*Heavy Metals.*—An aqueous solution of Alum does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of Alum meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Iron.—Add 5 drops of potassium ferrocyanide T.S. to 20 mils of an aqueous solution of Alum (1 in 150); no blue color is produced at once.

Assay.—Dissolve about 1 Gm. of the Alum, accurately weighed, and about 1 Gm. of ammonium chloride in 250 mils of distilled water and precipitate the aluminum hydroxide by the addition of a slight excess of ammonia water to the boiling solution. Collect the precipitate on a filter, wash it thoroughly with hot distilled water, dry, ignite strongly and weigh it. The aluminum oxide so obtained corresponds to not less than 99.5 per cent. of the Alum assayed. Each Gm. of aluminum oxide corresponds to 8.874 Gm. of $AlNH_4(SO_4)_2+12H_2O$ and to 9.286 Gm. of $AlK(SO_4)_2+12H_2O$.

U. S. P. Preparations.—Alumen Exsiccatum; Alumini Hydroxidum.

N. F. Preparations.—Liquor Alumini Acetico-Tartratis; Liquor Cocci.

Uses.—Alum is a powerful astringent. When powdered, it is used as an emetic in croup, in doses of a teaspoonful. It is sometimes used as a local styptic, and is frequently employed in making astringent lotions and injections. The dose as an astringent is from five to twenty grains (0.32 to 1.3 Gm.).

ALUMEN EXSICCATUM. U. S. Exsiccated Alum

[**Alum. Exsic.**—Alumen Ustum Dried Alum Burnt Alum]

It contains, when recently dried to constant weight at 200° C. (392° F.), not less than 96.5 per cent. of anhydrous $AlNH_4(SO_4)_2$ (237.28) or of anhydrous $AlK(SO_4)_2$ (258.34), the label of the container indicating whether it is made from Ammonium Alum or from Potassium Alum. Preserve it in well-closed containers and do not dispense it if it contains more than 10 per cent. of moisture.

	Metric	Old form
***Alum**, in small pieces	**100 Gm.**	20 oz. av.
To make	**55 Gm.**	11 oz. av.

Place the alum in a tared, shallow, porcelain dish so as to form a thin layer, and heat it cautiously on a sand bath until it liquefies. Then continue the application of heat, at a temperature not exceeding 200° C. (392° F.), with constant stirring, until aqueous vapors cease to be evolved and a dry, white, porous mass is obtained. When cold, reduce the product to a fine powder.

This preparation represents alum nearly deprived of its water of crystallization; the latter exists in alum in the enormous proportion of about 45 per cent., thus constituting almost half of its weight. Much care must be observed in the regulation of the heat during the exsiccation, as excessive temperatures above 200° C. (392° F.) produce insoluble compounds of alum, chiefly aluminum oxysulphate.

Official Description.—A white, granular powder, attracting moisture on exposure to the air.

Odor, Taste, and Reaction.—Without odor, possessing a sweetish, astringent taste.

Solubility.—One Gm. of Exsiccated Alum dissolves very slowly and usually incompletely in about 20 mils of water at 25° C. (77° F.), also in 1.5 mils of boiling water; insoluble in alcohol.

Tests for Identity and Impurities.—Add 2 Gm. of Exsiccated Alum to 40 mils of distilled water and allow it to stand, with occasional agitation, for twenty-four hours.

Collect the insoluble residue on previously dried and counterbalanced filters, wash with 50 mils of distilled water and finally dry at 100° C. (212° F.) until of constant weight; the residue weighs not more than 0.05 Gm.

Dry about 1 Gm. of Exsiccated Alum in an air bath, to constant weight at 200° C. (392° F.); the loss does not exceed 10 per cent.

An aqueous solution of Exsiccated Alum responds to the reactions and tests for Ammonium Alum or for Potassium Alum given under *Alumen*, allowance being made for the difference in strength.

Assay.—Dissolve about 0.5 Gm. of Exsiccated Alum, previously dried to constant weight at 200° C. (392° F.), and accurately weighed, in 100 mils of distilled water, filter if necessary, thoroughly wash the insoluble residue with distilled water, dilute the filtrate and washings to about 250 mils with distilled water, and add 1 Gm. of ammonium chloride. Proceed with the assay as directed under *Alumen*, beginning with the words "and precipitate," second line of the Assay. The aluminum oxide so obtained corresponds to not less than 96.5 per cent. of the previously dried Exsiccated Alum. Each gramme of aluminum oxide corresponds to 4.643 Gm. of $AlNH_4(SO_4)_2$ and to 5.055 Gm. of $AlK(SO_4)_2$.

Uses.—It is used as an escharotic and is more powerful than alum, although not so soluble.

ALUMINI HYDROXIDUM. U. S. Aluminum Hydroxide
[Alum. Hydrox.]

A compound consisting principally of aluminum hydroxide [$Al(OH)_3 = 78.12$].

	Metric	Old form
***Alum**	100 Gm.	16 oz. av.
Monohydrated Sodium Carbonate	45 Gm.	7 oz. av. 88 gr.
Water, a sufficient quantity.		

Dissolve each salt separately in 1000 mils [old form 10 pints] of water, filter the solutions and heat them to boiling. Then, having poured the hot solution of monohydrated sodium carbonate into a capacious vessel, gradually pour in the hot solution of alum with constant stirring, and afterwards add 2000 mils [old form 20 pints] of boiling water. Allow the precipitate to subside, decant the clear liquid, and mix the precipitate with 2000 mils [old form 20 pints] of hot water. Again decant, transfer the precipitate to a strainer, and wash it with hot water, until the washings produce not more than a faint cloudiness with barium chloride T.S. Allow the precipitate to drain, dry it at a temperature not exceeding 40° C. (104° F.), and reduce it to a uniformly fine powder.

$$\underset{\text{Potassium Alum}}{2AlK(SO_4)_2} + \underset{\text{Sodium Carbonate}}{3Na_2CO_3} + \underset{\text{Water}}{3H_2O} = \underset{\text{Aluminum Hydroxide}}{2Al(OH)_3} + \underset{\text{Potassium Sulphate}}{K_2SO_4} + \underset{\text{Sodium Sulphate}}{3Na_2SO_4} + \underset{\text{Carbon Dioxide}}{3CO_2}$$

The direction to add the alum solution to that of the sodium carbonate is important. If the mixing of the solution is reversed, the precipitated hydroxide will be contaminated with the alkali sulphates, so that it will be much more difficult to separate them.

Official Description.—A white, bulky, amorphous powder, permanent in dry air.

Odor and Taste.—Odorless and tasteless.

Solubility.—It is insoluble in water and alcohol; it is dissolved by hydrochloric or sulphuric acid and by the fixed alkali hydroxides.

Tests for Identity.—Solutions of Aluminum Hydroxide in hydrochloric or sulphuric acid yield with potassium hydroxide T.S. a white gelatinous precipitate, dissolved by an excess of the reagent but again precipitated by the addition of an excess of ammonium chloride.

When heated to redness it loses about 34 per cent. of its weight.

Impurities and Tests for Impurities.—*Alkali Salts.*—Boil 1 Gm. of Aluminum Hydroxide with 20 mils of distilled water, and filter the liquid; the filtrate does not show an alkaline reaction, and, on evaporation, does not leave a residue weighing more than 0.005 Gm.

Heavy Metals.—Heat 1 Gm. of Aluminum Hydroxide with 10 mils of hydrochloric acid, evaporate the solution to dryness, and dissolve the residue in 50 mils of distilled water. Ten mils of this solution does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Heat 1 Gm. of Aluminum Hydroxide with 5 mils of sulphuric acid and 5 mils of distilled water, on a water bath, for fifteen minutes. Then dilute it to 25 mils with distilled water and filter. Five mils of this filtrate meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Uses.—Aluminum hydroxide is a desiccant powder; it is absorbent and antacid. The dose is from two to five grains (0.13 to 0.32 Gm.). Externally, it is used like zinc oxide, by dusting on the inflamed surface.

LIQUOR ALUMINI ACETATIS. N. F. Solution of Aluminum Acetate

[**Liq. Alum. Acet.**—LIQUOR BUROWII BUROW'S SOLUTION]

One hundred mils of this solution contains not less than 4.5 and not more than 5.5 Gm. of neutral aluminum acetate [$Al(C_2H_3O_2)_3$ = 204.17].

	Metric	Old form
Lead Acetate	**150 Gm.**	5 oz. av. 3 gr.
Aluminum Sulphate	**85 Gm.**	2 oz. av. 366 gr.
Water, a sufficient quantity,		
To make	**1000 mils**	2 pints

Dissolve each salt in 500 mils [old form 1 pint] of water and mix the cold solutions by pouring the lead acetate solution in a thin stream, with constant stirring, into the aluminum sulphate solution. Set the mixture aside in a cold place [about 10° C. (50° F.)] for twenty-four hours, stirring it occasionally, and then siphon off the clear liquid. Transfer the magma to a strainer of fine texture, press it and add enough water through the magma to make the filtered mixed liquids measure 1000 mils [old form 2 pints]. Dispense only the clear Solution.

Assay.—Dissolve 1 Gm. of ammonium chloride in 5 mils of the Solution, accurately measured, and add enough distilled water to measure 250 mils. Precipitate the aluminum by the addition of a slight excess of ammonia water to the boiling solution, collect the precipitate on a filter, wash it thoroughly with hot distilled water, ignite it strongly, and weigh the residue. Each milliliter of Solution of Aluminum Acetate corresponds to not less than 0.01126 Gm. nor more than 0.01376 Gm. of aluminum oxide (Al_2O_3).

Uses.—Burow's Solution, usually diluted with water, is used as a nontoxic, antiseptic dressing, also as an astringent mouth-wash and gargle.

LIQUOR ALUMINI ACETICO-TARTRATIS. N. F. Solution of Aluminum Acetico-Tartrate

[**Liq. Alum. Acet.-Tart.**]

	Metric	Old form
Ammonium Alum	**750 Gm.**	26 oz. av. 199 gr.
Monohydrated Sodium Carbonate	**300 Gm.**	10 oz. av. 255 gr.
Glacial Acetic Acid	**150 Gm.**	5 oz. av. 127 gr.
Tartaric Acid	**135 Gm.**	4 oz. av. 333 gr.
Water, a sufficient quantity,		
To make	**1000 Gm.**	35 oz. av. 120 gr.

Dissolve the alum and monohydrated sodium carbonate each in 10,000 mils [old form 20 pints] of water, mix the solutions, and wash the precipitate with water, first by decantation, and afterwards on a strainer, until the washings are free from sulphate. Allow the precipitate to drain and to shrink in volume by exposure on the strainer, then transfer it to a tared dish, add the glacial acetic acid and the tartaric acid, and apply heat until solution is effected. Finally, evaporate the liquid to 1000 Gm. [old form 35 oz. av. 120 gr.].

Uses.—It is used as an astringent wash.

LIQUOR ALUMINI SUBACETATIS. N. F. **Solution of Aluminum Subacetate**

[**Liq. Alum. Subacet.**—LIQUOR ALUMINI ACETATIS, N. F. III]

An aqueous solution, containing not less than 7.5 per cent. nor more than 8 per cent. of basic aluminum acetate [$Al(C_2H_3O_2)_2OH = 162.15$].

	Metric	Old form
Aluminum Sulphate..........................	**300 Gm.**	10 oz. av. 255 gr.
Acetic Acid....................................	**300 Gm.**	10 oz. av. 255 gr.
Precipitated Calcium Carbonate...............	**138 Gm.**	4 oz. av. 380 gr.
Water, a sufficient quantity.		

Dissolve the aluminum sulphate in 900 mils [old form 30½ fl. oz.] of water, filter the solution, and gradually add the precipitated calcium carbonate, in several portions, with constant stirring. Then slowly add the acetic acid and set the mixture aside for several days, stirring occasionally. Siphon off the clear liquid, transfer the magma to a strainer, press it and add enough water through the magma to bring the filtered, mixed liquids to a specific gravity of 1.045 at 25° C. (77° F.).

Assay.—Add to about 4 mils of the Solution, accurately weighed, 1 Gm. of ammonium chloride and enough distilled water to measure 250 mils. Precipitate the aluminum by the addition of a slight excess of ammonia water to the boiling solution. Collect the precipitate on a filter, wash it thoroughly with hot distilled water, ignite it strongly and weigh the residue. Each gramme of Solution of Aluminum Subacetate corresponds to not less than 0.02363 Gm. nor more than 0.02521 Gm. of aluminum oxide (Al_2O_3).

Uses.—It is used as an antiseptic and astringent wash.

ALUMINI CHLORIDUM. N. F. **Aluminum Chloride**

[**Alum. Chlor.**]

It contains, when dried over sulphuric acid, $AlCl_3 + 6H_2O$ (241.58) corresponding to not less than 20.5 per cent. of aluminum oxide (Al_2O_3). Preserve it in well-closed containers.

Preparation.—It may be prepared by acting on a solution of aluminum sulphate with barium chloride, filtering out the barium sulphate and concentrating and crystallizing the filtrate.

Official Description.—A white, or yellowish-white, deliquescent, crystalline powder.

Odor, Taste, and Reaction.—Nearly odorless; taste sweetish and very astringent. An aqueous solution of the salt (1 in 10) is clear, and is acid to litmus.

Solubility.—One gramme dissolves in about 0.5 mil of water and in about 4 mils of alcohol at 25° C. (77° F.); also soluble in glycerin.

Tests for Identity.—Separate portions of an aqueous solution in the salt (1 in 10) yield with silver nitrate T.S. a white, curdy precipitate insoluble in nitric acid, with ammonia water a white, gelatinous precipitate almost insoluble in an excess of ammonia water, and with sodium hydroxide T.S. a white, gelatinous precipitate completely soluble in an excess of the reagent.

Impurities and Tests for Impurities.—*Sulphate.*—Ten mils of an aqueous solution of the salt (1 in 100), after the addition of 0.2 mil of barium chloride T.S., does not become cloudy within one minute.

Iron.—The addition of 0.3 mil of potassium ferrocyanide T.S. to 20 mils of an aqueous solution of the salt (1 in 150) does not produce a blue coloration within one minute.

Zinc.—The addition of hydrogen sulphide T.S. to 10 mils of an aqueous solution of the salt (1 in 10) does not produce a white precipitate or turbidity.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of the salt meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Dissolve about 0.5 Gm. of the salt, previously dried in a desiccator and accurately weighed, in 100 mils of distilled water, add 1 Gm. of ammonium chloride and then precipitate the aluminum hydroxide by the addition of a slight excess of ammonia water to the boiling solution. Collect the precipitate on a filter, wash it with distilled water, dry, ignite thoroughly and weigh. The weight of the aluminum oxide so obtained is not less than 20.5 per cent. of the weight of the Aluminum Chloride taken for the assay.

N. F. Preparation.—Liquor Hydrastinæ Compositus.

Uses.—Used in solution or pills in doses of two to five grains (0.13 to 0.32 Gm.). Because of the deliquescence of the salt, if made into pills they should be massed with Canada turpentine and powdered althæa. It is an astringent and antiseptic. The solution sold as *chloralum* is said to be a 20 per cent. aqueous solution of aluminum chloride. Many proprietary preparations, sold as *perspiration preventatives* or as *deodorants,* are solutions of aluminum chloride, some being as high as 33 per cent. in strength.

ALUMINI SULPHAS. N. F. Aluminum Sulphate

(U.S.P. VIII)

[Alum. Sulph.]

It contains not less than 99.5 per cent. of $Al_2(SO_4)_3+16H_2O$ (630.67).

Preparation.—Take of alum, sodium carbonate, each 4 oz. troy; sulphuric acid, 1 oz. troy, 150 gr.; distilled water, a sufficient quantity. Dissolve the salts separately, each in 6 fluidounces of boiling water, and pour the solution of the alum gradually into that of the sodium carbonate; then digest with a gentle heat until the evolution of carbon dioxide ceases. Collect upon a filter the precipitate formed, and wash it with water, until the washings are no longer affected by barium chloride T.S. Next, with the aid of heat, dissolve the precipitate in the sulphuric acid, previously diluted with half a pint of water, and, having filtered the solution, evaporate it until a pellicle begins to form. Then remove it to a water bath, and continue the evaporation, with constant stirring, until a dry salt remains. Lastly, preserve this in a well-stoppered bottle.

Another method may be used: the freshly precipitated hydroxide obtained by the process given on page 845 may be dissolved in diluted sulphuric acid, the solution evaporated, and the salt granulated.

Official Description.—A white, crystalline powder, shining plates, or crystalline fragments; permanent in the air.

Odor, Taste, and Reaction.—Without odor, having a sweetish and afterwards an astringent taste. An aqueous solution of the salt (1 in 20) is acid to litmus.

Solubility.—One gramme dissolves in 1 mil of water at 25° C. (77° F.); more soluble in boiling water, but insoluble in alcohol.

When gradually heated to about 200° C. (392° F.), it loses its water of crystallization (about 45.7 per cent. of its weight).

Tests for Identity.—Separate portions of an aqueous solution of the salt (1 in 20) yield with barium chloride T.S. a white precipitate insoluble in hydrochloric acid, and with sodium hydroxide T.S. a white gelatinous precipitate which is soluble in an excess of the alkali, but which is again separated on the addition of a sufficient amount of ammonium chloride T.S.

Gently heat 1 Gm. of Aluminum Sulphate with 10 mils of sodium hydroxide T.S.; the liquid does not evolve the odor of ammonia.

Impurities and Tests for Impurities.—*Free Acid.*—A filtered aqueous solution of the salt (1 in 10) does not become more than faintly opalescent within five minutes after the addition of an equal volume of tenth-normal sodium thiosulphate V.S.

Iron.—The addition of 5 drops of potassium ferrocyanide T.S. to 20 mils of an aqueous solution of the salt (1 in 150) does not produce at once a blue coloration.

Heavy Metals.—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of the salt meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Dissolve about 0.5 Gm. of Aluminum Sulphate, accurately weighed, in 100 mils of distilled water, add 1 Gm. of ammonium chloride and then precipitate the aluminum hydroxide by the addition of a slight excess of ammonia water to the boiling solution. Collect the precipitate on a filter, wash it with distilled water, dry, ignite thoroughly and weigh. The weight of the aluminum oxide so obtained is not less than 16.1 per cent. of the weight of the Aluminum Sulphate taken for the assay, corresponding to not less than 99.5 per cent. of $Al_2(SO_4)_3+16H_2O$.

N. F. Preparations.—Liquor Alumini Acetatis; Liquor Alumini Subacetatis; Liquor Zinci et Alumini Compositum.

Uses.—Aluminum sulphate is antiseptic; it is rarely used internally.

PUMEX. N. F. Pumice

A substance of volcanic origin, consisting chiefly of complex silicates of aluminum, potassium, and sodium.

Official Description.—It occurs as very light, hard, rough, porous gray masses, or as a gritty, gray-colored powder. It is permanent in the air. The dry masses usually float on water.

Odor and Taste.—Odorless and tasteless.

Impurities and Tests for Impurities.—*Soluble Substances.*—Boil 10 Gm. of Pumice with 50 mils of distilled water for one-half hour, adding distilled water from time to time to maintain approximately the original volume, and then filter; the filtrate is neutral to litmus, and one-half of this filtrate, when evaporated and the residue dried to constant weight at 110° C. (230° F.), yields not more than 0.01 Gm. of residue.

Iron.—The remaining half of the filtrate, after slightly acidulating with hydrochloric acid, does not yield a blue color with potassium ferrocyanide T.S.

Boil 1 Gm. of Pumice with 25 mils of diluted hydrochloric acid for one-half hour, adding distilled water from time to time to maintain approximately the original volume, and then filter the liquid; the filtrate yields upon evaporating to dryness, igniting and quickly weighing, not more than 0.05 Gm. of residue.

Uses.—Pumice is used as a filtering and distributing medium in several N. F. Preparations.

Cerium. Ce; 140.25

Cerium is a metal occurring in *cerite, gadolinite, monazite,* etc.; it is of a chocolate-brown color, in masses, and has been obtained by the electrolysis of the chloride; it takes fire more easily than magnesium; at ordinary temperatures it oxidizes in a moist atmosphere. Two oxides of cerium are known, Ce_2O_3, *cerous oxide,* and CeO_2, *ceric oxide.*

Test for Cerium Compounds

If sodium hypochlorite be added to a solution of a colorless cerous salt, a red precipitate separates; this dissolves in warm hydrochloric acid, and evolves chlorine.

Official Salt of Cerium

Official Name	Preparation
Cerii Oxalas	By precipitating cerium chloride with oxalic acid

Unofficial Salts of Cerium

Ceroso-cerii Oxidum, Ce_3O_4 Ceroso-ceric Oxide	By igniting cerium oxalate in an open vessel and then collecting the mass
Cerii Chloridum, $CeCl_2$ Cerium Chloride	By burning cerium in chlorine gas and then collecting the mass
Cerii Nitras, $CeNO_3 + 2H_2O$ Cerium Nitrate	By dissolving ceroso-ceric oxide in nitric acid in presence of alcohol or some other reducing substance
Cerii Oxidum, CeO Cerium Oxide	By heating cerium oxalate in a current of dry hydrogen perfectly free from air
Cerii Sulphas, $Ce_2(SO_4)_3$ Cerium Sulphate	By dissolving ceric oxide in sulphuric acid, and evaporating, then crystallizing

CERII OXALAS. U. S. Cerium Oxalate

[Cerii Oxal.]

A mixture of the oxalates of cerium, didymium, lanthanum, and other associated elements.

Preparation.—This salt is made by decomposing the silicates in the powdered mineral containing the metal, with strong sulphuric acid, then heating the mass, and subsequently treating it with nitric acid and hydrogen sulphide to separate contaminating metals. Hydrochloric acid is now added in small quantity, and the cerium compounds are precipitated by oxalic acid. This oxalate is impure, containing lanthanum, didymium and other associated elements; to purify it, as far as practicable, it is mixed with magnesium carbonate, and the mixture heated to redness to decompose the oxalates; the residue is dissolved in a small quantity of nitric acid, and the solution added to water containing a little sulphuric acid; ceric sulphate is produced, which is dissolved in sulphuric acid, and sodium thiosulphate added to reduce it to cerous sulphate; this is collected and treated with oxalic acid, when cerium oxalate precipitates. A commercial source of cerium salts to-day is as a by-product in the gas mantle industry.

Official Description.—A fine white or slightly pink powder, permanent in the air.

Odor and Taste.—Without odor or taste.

Solubility.—It is insoluble in water, alcohol, ether, and in solutions of potassium or sodium hydroxide; insoluble in cold, diluted sulphuric or hydrochloric acid, but dissolved by these acids when heated.

Tests for Identity.—When heated to redness it is decomposed, leaving not less than 47 per cent. of a reddish-brown residue.

Boil Cerium Oxalate with potassium hydroxide T.S.; an insoluble precipitate of white hydroxides is produced. Filter and supersaturate the filtrate with acetic acid; the addition of calcium chloride T.S. produces a white precipitate, insoluble in acetic acid but soluble in hydrochloric acid.

From a solution of Cerium Oxalate in diluted hydrochloric or sulphuric acid, potassium hydroxide T.S., added in slight excess, precipitates white hydroxides, which do not redissolve in a larger excess of the reagent, but gradually turn yellow in contact with air. Ammonium carbonate T.S. added in slight excess to a similar acid solution produces a white precipitate of the mixed carbonates of cerium and associated elements, which is somewhat soluble in a larger excess of the reagent.

Dissolve 0.1 Gm. of Cerium Oxalate in 1 mil of sulphuric acid and add 2 mils of potassium sulphate T.S.; small, colorless crystals of double sulphates of potassium and the rare-earth elements in the mixture are deposited after some time.

Impurities and Tests for Impurities.—*Carbonates.*—No effervescence occurs when Cerium Oxalate is dissolved in diluted hydrochloric acid.

Heavy Metals.—A solution of Cerium Oxalate (1 in 50) in diluted hydrochloric acid does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—A solution of Cerium Oxalate (1 in 25) in hot dilute sulphuric acid (1 in 3) meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Aluminum.—Boil 0.3 Gm. of Cerium Oxalate with 15 mils of potassium hydroxide T.S. and filter. No precipitate is produced in 5 mils of the filtrate by boiling with an excess of ammonium chloride T.S.

Zinc.—Or in another 5-mil portion of the filtrate by the addition of sodium sulphide T.S.

Uses.—Cerium oxalate is a valuable remedy in controlling nausea. It is given in doses of one to ten grains (0.065 to 0.65 Gm.).

Cadmium. Cd; 112.40

This metal is associated with zinc in its ores. Although it enters into *no official preparations*, it is used to some extent in medicine, and hence merits a notice here. It is a white metal, resembling tin, but somewhat heavier and more tenacious. Like that metal, it crackles when bent. Its specific gravity is 8.6 and the metal melts at 320° C. (608° F.) and boils at 770° C. (1418° F.). It is little affected by the air, but when heated combines with an atom of oxygen, forming a reddish-brown or orange-colored oxide, CdO. It combines with chlorine, iodine, bromine, and sulphur.

Tests for Cadmium Salts

1. Hydrogen sulphide and ammonium sulphide produce precipitates of a yellow color (sulphide) when added to solutions of cadmium salts.

2. Sodium or potassium hydroxide produces, with cadmium salts, white precipitates (hydroxides), insoluble in excess. Ammonia water produces similar precipitates, soluble in excess.

3. Sodium or potassium carbonate produces white precipitates of cadmium carbonate, insoluble in excess.

Unofficial Compounds of Cadmium

Cadmii Bromidum, $CdBr_2$ Cadmium Bromide	By double decomposition between potassium bromide and cadmium sulphate. Used in photography
Cadmii Chloridum, $CdCl_2$ Cadmium Chloride	By treating cadmium or cadmium carbonate with hydrochloric acid
Cadmii Iodidum, CdI_2 Cadmium Iodide	By double decomposition between potassium iodide and cadmium sulphate. Used in photography
Cadmii Oxidum, CdO Cadmium Oxide	By igniting cadmium nitrate or carbonate
Cadmii Sulphidum, CdS Cadmium Sulphide	By passing hydrogen sulphide through a solution of cadmium chloride, nitrate, or sulphate
Cadmii Sulphas, $CdSO_4+4H_2O$ Cadmium Sulphate	By treating cadmium carbonate or oxide with diluted sulphuric acid

QUESTIONS ON ZINC, ALUMINUM, CERIUM, AND CADMIUM

Zinc—Give symbol and atomic weight. (See page 831.)
In what form is zinc official? How is it made?
What chemical affiliations does it readily form?
What are the tests for zinc salts?
Describe odor, taste, chemical reaction, and solubility.
How may the following impurities be detected?—Sulphur; arsenic; antimony and phosphorus.
What are its uses?
Zinc acetate—Give formula in symbols and molecular weight.
Describe a process by which it may be prepared.
Describe odor, taste, chemical reaction, solubility and tests for identity.
How may the following impurities be detected?—Arsenic; heavy metals.
For what is it used?
Precipitated zinc carbonate—Give Latin name, formula in symbols, and molecular weight.
Describe a process for making this salt.
Describe appearance, odor, taste, chemical reaction, solubility and tests for identity.
How may the following impurities be detected?—Alkali; heavy metals.
For what is it used?
Zinc chloride—What is its formula in symbols?
How is it prepared?
Describe appearance, odor, taste, chemical reaction, solubility and tests for identity.

How may the following impurities be detected?—Oxychloride; heavy metals; ammonium salts; sulphate.
For what purposes is it used?
Solution of zinc chloride—What is the Latin official name?
How much zinc chloride does it contain? How is it prepared?
How may it be freed from iron which is usually present in the zinc from which it is prepared? Give description and specific gravity.
What is this solution sometimes called? For what is it used?
Zinc oxide—Give Latin name, formula in symbols, and molecular weight.
By what processes may it be made?
What is the difference between commercial zinc oxide and the official preparation?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Alkali; heavy metals.
For what purposes is it used?
Zinc phenolsulphonate—What is the Latin title and formula in symbols?
By what other name is it known? How may it be made?
Give the description, odor, taste, chemical reaction, and solubility.
What are the tests for identity?
How may the following impurities be detected?—Arsenic; heavy metals; sulphate.
For what purpose is it used?
Zinc stearate—What is the Latin title?
How may this salt be made?
Give description, odor, taste, reaction and solubility. What are the tests for identity?
How may the following impurities be detected?—Alkalies; alkali earths.
For what is it used medicinally?
Zinc sulphate—How is it prepared?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Arsenic; heavy metals; chloride; free acid; alkali and alkali earth salts.
What are its uses and the dose?
Zinc valerate—What is the official Latin title? What is its synonym? How is this salt prepared?
What is meant by upward precipitation?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Arsenic; heavy metals; acetate; butyrate.
What are its uses and the dose?
Prepared calamine—Give the Latin title and synonyms.
How is it obtained and purified?
Describe appearance, solubility, and tests for impurities. What are its uses?
Compound solution of zinc and aluminum—How is it prepared? What are its uses?
Compound solution of zinc and iron—How is it prepared and used?
Aluminum—Give symbol and atomic weight.
Where is this found? Give description and specific gravity.
What is its chemical quantivalence?
What are the salts known as alums?
What are the tests for salts of aluminum?
Alum—Give formulas in symbols.
What two varieties of alum are recognized by the U. S. P.?
How are they generally made?
With how many molecules of water does alum crystallize?
Why is soda alum not generally used?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Heavy metals; arsenic; iron.
For what is it used medicinally? What is the dose?
Exsiccated alum—Give its Latin official name.
What other names are used for exsiccated alum?
How is it prepared? Why is it necessary to observe caution in heating it?
How much water does alum contain?

Describe odor, taste, chemical reaction, and solubility.
For what is it used?
Aluminum hydroxide—Give formula in symbols.
How is it prepared?
In what manner should the solutions be mixed, and why?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Alkali salts; heavy metals; arsenic. For what is it used medicinally?
What is the dose?
Solution of aluminum acetate—What are its synonyms? How is the solution prepared? What is its strength? How used medicinally?
Solution of aluminum acetico-tartrate—How is it prepared? What are its medicinal uses?
Solution of aluminum subacetate—What is its strength? How prepared and used?
Aluminum chloride—How may it be prepared?
Describe appearance, odor, taste, solubility, and tests for identity.
What impurities are likely to be present and how detected?
What are its uses and the dose?
Aluminum sulphate—Give formula in symbols and molecular weight.
By what process may it be made?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Arsenic; free acid; heavy metals; iron. What is it used for?
Pumice—What is its source?
Give description, odor and taste. What impurities are likely to be present and how detected? What are its uses?
Cerium—Give symbol and atomic weight.
Where is it found, and what are its physical properties?
What oxides are known, and what is their composition?
What is the test for cerium compounds?
What official preparation is there of cerium?
Cerium oxalate—Give Latin name, formula in symbols, and molecular weight.
How is this salt made?
What two rare metals are usually found in combination with cerium?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Carbonate; heavy metals; arsenic; aluminum; zinc. For what is this salt used in medicine?
What is the dose?
Cadmium—Give symbol, atomic weight, description, and specific gravity.
Describe odor, taste, and chemical reaction.
What combination does it form?
What are the tests for cadmium salts?

CHAPTER XLIV

MANGANESE, IRON, CHROMIUM, AND URANIUM

Mn; 54.93. Fe; 55.84. Cr.; 52.0 U; 238.5

These three metals form a group exhibiting some chemical and physical analogies. They unite with oxygen, producing basic oxides.

Manganese. Mn; 54.93

Manganese is found, as a mineral, quite extensively in the state of black oxide, as *pyrolusite*, *braunite*, and *hausmannite*. The carbonate also is sometimes found. The metal is very hard and brittle, is gray and lustrous in appearance, has a specific gravity from 7.2 to 7.8 and melts at 1247° C.; when powdered, it decomposes water readily. A very pure product is obtained by the Goldschmidt method whereby manganese dioxide is reduced with finely divided metallic aluminum. With oxygen it forms five—possibly seven—compounds. The *monoxide*, or *manganous oxide*, MnO, is of a light green color, and is the oxide present in or corresponding to manganous salts. The *sesquioxide*, Mn_2O_3, is black or dark brown, when in the hydrated state; the magnetic oxide, or *manganous-manganic oxide*, Mn_3O_4, is the native hausmannite and is brown-black in color; the dioxide, MnO_2, is black; and the permanganic oxide, Mn_2O_7, is, when in the free state, a very unstable dark reddish-brown liquid. The monoxide is a stable base, the sesquioxide feebly basic, and the dioxide when acted upon by acids yields manganous salts, while oxygen is evolved. The highest oxide is acid-forming, yielding permanganic acid, $HMnO_4$, the salts of which are known as permanganates. There exists also an acid, H_2MnO_4 (manganic), of which the salts formed are called manganates. The corresponding oxide, however, is not known.

Tests for Salts of Manganese

1. Ammonium sulphide, added to a solution of a manganese salt, produces a flesh-colored precipitate of manganese sulphide.
2. Potassium or sodium carbonate in solution produces white precipitates, which are insoluble in excess of solution of ammonium carbonate.
3. With the blowpipe, manganese gives with borax a bead having an amethystine color in the oxidizing flame, and a colorless bead in the deoxidizing flame.
4. If manganese be heated with sodium carbonate, *green* sodium manganate is produced. If this is added to water, it communicates a purplish-red color.

U. S. P. Salts of Manganese

Official Name	Preparation
Mangani Dioxidum Præcipitatum	Manganese dioxide, containing at least 80 per cent. of pure oxide made by adding ammonia water and solution of hydrogen dioxide to a solution of manganese sulphate, collecting the precipitate, washing and drying
Potassii Permanganas	By heating manganese dioxide, potassium hydroxide, and potassium chlorate together

N. F. Salts of Manganese

Official Name	Preparation
Mangani Citras Solubilis	A mixture of manganese citrate and sodium citrate
Glycerophosphas Solubilis	Prepared by neutralizing glycerophosphoric acid with manganese carbonate, precipitating the glycerophosphate with alcohol and adding sufficient citric acid to render it soluble
Hypophosphis	By reaction between manganous carbonate and calcium hypophosphite
Sulphas	Made by treating manganese dioxide with sulphuric acid

Unofficial Salts of Manganese

Mangani Arsenas, $MnHAsO_4$ Manganese Arsenate	By saturating a solution of arsenic acid with freshly preciptated manganese carbonate
Mangani Benzoas, $Mn(C_7H_5O_2)_2+3H_2O$ Manganese Benzoate	By adding to a solution of benzoic acid manganese carbonate as long as combination is effected
Mangani Carbonas, $MnCO_3$ Manganese Carbonate	By adding to a solution of manganese sulphate a solution of potassium carbonate, and collecting and drying the precipitate
Mangani Chloridum, $MnCl_2$ Manganous Chloride	By treating manganese dioxide with hydrochloric acid, purifying from iron salts, evaporating, and crystallizing
Mangani Citras Manganese Citrate	By digesting manganese carbonate with citric acid, and collecting the precipitate
Mangani Oxalas, $2\ MnC_2O_4+5H_2O$ Manganese Oxalate	By adding to a solution of manganese sulphate a solution of oxalic acid, and collecting the precipitate
Mangani Tartras Manganese Tartrate	By adding a solution of neutral potassium tartrate to a solution of manganous chloride, and, after the acid potassium tartrate has deposited, collecting the colorless crystals

MANGANI DIOXIDUM PRÆCIPITATUM. U. S. Precipitated Manganese Dioxide

[Mangan. Diox. Præc.]

It consists chiefly of manganese dioxide [$MnO_2=86.93$] with small amounts of other oxides of manganese, corresponding to not less than 80 per cent. of MnO_2.

Preparation.—The U. S. P. IX has omitted the process for this salt, but the U. S. P. VIII process was as follows:

	Metric	Old form	
Manganese Sulphate	**50 Gm.**	2 oz. av.	
Ammonia Water	**250 mils**	9 fl. oz.	153 min.
Solution of Hydrogen Dioxide	**250 mils**	9 fl. oz.	153 min.
Distilled Water, a sufficient quantity.			

Dissolve the manganese sulphate in 1000 mils [old form 37 fl. oz.] of distilled water. Dilute the ammonia water with an equal volume of distilled water, and mix it with the solution of hydrogen dioxide which has also been diluted with an equal volume of distilled water. Pour the mixed solutions slowly, with constant stirring, into the solution of manganese sulphate. Allow the mixture to stand for one hour, stirring frequently. Then decant the supernatant clear liquid from the precipitate, and wash the latter repeatedly by affusion and decantation with hot distilled water, using 1000 mils [old form 37 fl. oz.] each time. Collect the precipitate on a plain filter, and continue the washing with hot distilled water until the washings no longer have an alkaline reaction upon red litmus paper, and produce no turbidity when mixed with barium chloride test solution. Allow the precipitate to drain, then dry it at 150° C. (302° F.).

Black oxide of manganese of poor and variable quality is frequently found in commerce. It is the safest rule to buy it only upon assay, and, when a good sample can be found, to secure a large quantity of it.

Official Description.—A heavy, very fine, black powder; permanent in the air.
Odor and Taste.—Without odor or taste.
Solubility.—Insoluble in water or alcohol.
Tests for Identity.—When heated with hydrochloric acid, it is converted into manganous chloride and chlorine is evolved. At a red heat Precipitated Manganese Dioxide gives off oxygen and is converted into reddish-brown manganous-manganic oxide (Mn_3O_4).
Add 2 drops of hydrochloric acid to about 0.1 Gm. of precipitated Manganese Dioxide contained in a test tube, boil the mixture for one minute with 0.5 Gm. of lead peroxide and 5 mils of nitric acid and then add 5 mils of distilled water; the liquid assumes a reddish-violet color.
Impurities and Tests for Impurities.—*Insoluble Substances.*—Add 20 mils of distilled water to 1 Gm. of Manganese Dioxide and 2 Gm. of oxalic acid, follow this by 3 mils of sulphuric acid, and digest the mixture for several hours on a water bath; not more than 0.2 per cent. of residue remains.
Assay.—Dissolve about 0.2 Gm. of Precipitated Manganese Dioxide, accurately weighed, in a mixture of 50 mils of tenth-normal oxalic acid V.S. and 3 mils of sulphuric acid, heat to 80° C. (176° F.) on a water bath, and titrate the residual oxalic acid with tenth-normal potassium permanganate V.S. It shows not less than 80 per cent. of MnO_2.
Each mil of tenth-normal oxalic acid V.S. used corresponds to 0.0043465 Gm. of MnO_2. Each gramme of Precipitated Managese Dioxide corresponds to not less than 184 mils of tenth-normal oxalic acid V.S.

Uses.—Precipitated manganese dioxide is occasionally used internally, in doses of three to twenty grains (0.2 to 1.3 Gm.). The commercial manganese dioxide is principally used to form the salts of manganese and officially in preparing chlorine water, which will be found among the reagents (see Chapter LXII).

MANGANI CITRAS SOLUBILIS. N. F. Soluble Manganese Citrate
[**Mangan. Cit. Sol.** MANGANESE AND SODIUM CITRATE]

Manganous citrate rendered soluble by the aid of sodium citrate. It corresponds, when dried to constant weight at 120° C. (248° F.), to not less than 49 per cent. nor more than 51 per cent. of $Mn_3(C_6H_5O_7)_2$ (542.87). Preserve it in well-closed containers.

Official Description.—It occurs as a yellowish or pinkish-white powder, or as translucent scales. It is permanent in the air.
Odor, Taste, and Reaction.—Odorless, and having a slightly bitter and astringent taste. An aqueous solution of Soluble Manganese Citrate (1 in 20) is neutral or slightly alkaline to litmus, but does not redden phenolphthalein T.S.
Solubility.—One gramme dissolves slowly in about 4 mils of water; slightly more soluble in boiling water, nearly insoluble in alcohol.
Tests for Identity.—When strongly heated, it chars and finally leaves a residue which effervesces with acids and imparts an intensely yellow color to a non-luminous flame.
An aqueous solution of Soluble Manganese Citrate (1 in 20), rendered alkaline with ammonia water, yields a salmon-colored precipitate on warming with ammonium sulphide T.S.
Ten mils of an aqueous solution of Soluble Manganese Citrate (1 in 20), slightly acidulated with acetic acid and mixed with 2 mils of calcium chloride T.S., remains clear while cold, but yields a white crystalline precipitate when heated to boiling.
Impurities and Tests for Impurities.—*Iron.*—Separate portions of 10 mils each of an aqueous solution of Soluble Manganese Citrate (1 in 100), when acidulated with hydrochloric acid, are not more than slightly reddened by potassium sulphocyanate T.S.
Sulphate.—Nor rendered turbid at once by barium chloride T.S.
Chloride.—Nor show more than an opalescence with silver nitrate T.S. when acidulated with nitric acid.
Tartrates or Other Readily Carbonizable Substances.—Mix about 0.5 Gm. of Soluble Manganese Citrate with 5 mils of sulphuric acid in a porcelain dish previously rinsed with sulphuric acid, protect the mixture from dust, and heat it for fifteen minutes on a water bath; no color darker than yellow develops.

Heavy Metals.—An aqueous solution of Soluble Manganese Citrate does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dissolve about 0.5 Gm. of Soluble Manganese Citrate, previously dried to constant weight at 120° C. (248° F.) and accurately weighed, in 100 mils of distilled water, add 50 mils of solution of hydrogen dioxide, and 10 mils of ammonia water, and boil the mixture for several minutes. Collect the precipitate on a filter, wash it thoroughly with hot distilled water, dry and ignite to constant weight. The weight of the manganous-manganic oxide (Mn_3O_4) so obtained is not less than 20.65 per cent. nor more than 21.5 per cent. of the weight of the salt taken, corresponding to not less than 49 per cent. nor more than 51 per cent. of $Mn_3(C_6H_5O_7)_2$. Each gramme of manganous-manganic oxide is equivalent to 2.3728 Gm. of $Mn_3(C_6H_5O_7)_2$.

N. F. Preparation.—Liquor Ferri Peptonati et Mangani.

Uses.—It is used as a tonic and alterative in doses of three to five grains (0.2 to 0.32 Gm.).

MANGANI GLYCEROPHOSPHAS SOLUBILIS. N. F. Soluble Manganese Glycerophosphate

[**Mangan. Glycerophos. Sol.** SOLUBLE MANGANOUS GLYCERINOPHOSPHATE]

Manganous Glycerophosphate rendered soluble by the aid of citric acid. It contains not less than 70 per cent. nor more than 75 per cent. of $MnC_3H_7PO_6$ (225.03). Preserve it in well-closed containers.

Official Description.—It occurs as a yellowish or pinkish-white powder.

Odor, Taste, and Reaction.—Odorless, and having an acid taste. The aqueous solution is strongly acid to litmus and becomes turbid on heating.

Solubility.—One gramme dissolves in 4 mils of water at 25° C. (77° F.). Alcohol dissolves the citric acid, leaving a residue which is nearly insoluble in water.

Tests for Identity.—Add an excess of ammonium sulphide T.S. to an aqueous solution of Soluble Manganese Glycerophosphate; on standing, it yields a salmon-colored precipitate soluble in acetic acid.

Heat a powdered mixture of about 0.1 Gm. of Soluble Manganese Glycerophosphate and about 0.5 Gm. of potassium bisulphate; pungent vapors of acrolein are evolved.

Impurities and Tests for Impurities.—*Phosphate.*—No yellow turbidity is produced immediately on mixing 5 mils of an aqueous solution (1 in 20) with 10 mils of ammonium molybdate T.S., but on prolonged standing, or on heating, a yellow precipitate is formed.

Sulphate.—Separate portions of 10 mils each of an aqueous solution of Soluble Manganese Glycerophosphate (1 in 20) are not rendered more than slightly turbid by barium chloride T.S. when mixed with a few drops of hydrochloric acid.

Chloride.—Nor by silver nitrate T.S., after acidulation with nitric acid.

Iron.—Add a few drops of hydrochloric acid and 1 mil of chlorine T.S. to 10 mils of an aqueous solution of Soluble Manganese Glycerophosphate (1 in 200) and boil; no reddish color is produced in the liquid by potassium sulphocyanate T.S. after cooling.

Heavy Metals.—An aqueous solution of Soluble Manganese Glycerophosphate does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dissolve about 0.5 Gm. of Soluble Manganese Glycerophosphate, accurately weighed, in 100 mils of distilled water, add 10 mils of ammonia water and 5 mils of ammonium sulphide T.S. and boil the mixture until the precipitate formed has become greenish. Allow the precipitate to settle, then transfer it to a filter, wash with hot distilled water containing a few drops of ammonium sulphide T.S., dry the filter and contents and incinerate them in an open crucible, first at a low temperature and then at strong red heat, until the weight is constant. The residue of manganous-manganic oxide (Mn_3O_4) so obtained is not less than 23.7 per cent. nor more than 25.4 per cent. of the weight taken, corresponding to not less than 70 per cent. nor more than 75 per cent. of $MnC_3H_7PO_6$. Each gramme of manganous-manganic oxide is equivalent to 2.95 Gm. of $MnC_3H_7PO_6$.

N. F. Preparation.—Elixir Glycerophosphatum Compositum.

Uses.—It is used as a nervine and alterative in doses of three to five grains (0.2 to 0.32 Gm.).

MANGANI HYPOPHOSPHIS. N. F. Manganese Hypophosphite
(U. S. P. VIII)
[Mangan. Hypophos.]

It contains not less than 97 per cent. of $Mn(PH_2O_2)_2+H_2O$ (203.06). Preserve it in well-closed containers.

Preparation.—It may be prepared by dissolving manganese carbonate in hypophosphorous acid, in molecular proportion, and crystallizing from the hot aqueous solution or by boiling together solutions of barium hypophosphite and manganese sulphate, filtering out the barium sulphate, evaporating the filtrate and crystallizing.

Official Description.—It is a pink, granular or crystalline powder; permanent in the air

Odor, Taste, and Reaction.—Odorless and nearly tasteless. An aqueous solution of the salt (1 in 20) is neutral or acid to litmus.

Solubility.—It is freely soluble in water; insoluble in alcohol.

Tests for Identity.—An aqueous solution of the salt (1 in 20) yields with ammonium sulphide T.S. a salmon-colored precipitate of manganese sulphide, soluble in acetic acid.

When strongly heated in a dry test tube, the salt evolves spontaneously inflammable hydrogen phosphide and finally leaves a residue of manganous pyrophosphate.

When an aqueous solution of the salt (1 in 20), acidulated with hydrochloric acid, is added, drop by drop with agitation, to an excess of mercuric chloride T.S., a white precipitate of mercurous chloride is formed, and, upon the further addition of the solution of Manganese Hypophosphite, the precipitate becomes gray from reduction to metallic mercury.

Impurities and Tests for Impurities.—*Carbonate.*—Add about 0.5 Gm. of the salt to 5 mils of acetic acid; no effervescence is produced.

Phosphate.—Boil 0.25 Gm. of the salt with 10 mils of sodium hydroxide T.S.; a white precipitate is formed which gradually acquires a brown color on exposure to the air. The filtrate from this mixture, after being slightly acidulated with hydrochloric acid, boiled for a minute, and then rendered alkaline with ammonia water, yields no precipitate upon the addition of magnesia mixture T.S.

Sulphate.—Dissolve 1 Gm. of the salt in 20 mils of diluted hydrochloric acid with the aid of heat, and then add 1 mil of barium chloride T.S.; not more than a slight turbidity is produced.

Calcium.—Dissolve 0.5 Gm. of Manganese Hypophosphite in 10 mils of hot distilled water, add 10 mils of solution of hydrogen dioxide and 10 mils of sodium hydroxide T.S., boil for one minute, then render slightly acid with acetic acid and again warm. Now cool, filter, and add 1 mil of ammonium oxalate T.S. to 10 mils of the filtrate; no turbidity is produced within five minutes.

Arsenic.—Pour 5 mils of an aqueous solution of the salt (1 in 30) into an evaporating dish containing 3 mils of nitric acid diluted with about 10 mils of distilled water, and evaporate to dryness on a water bath; the residue does not respond to the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Dissolve about 1 Gm. of Manganese Hypophosphite, accurately weighed, in 30 mils of boiling distilled water in a 250-mil measuring flask. Add 25 mils of solution of hydrogen dioxide and 15 mils of sodium hydroxide T.S. and heat for ten minutes on a water bath with frequent agitation. Cool, add distilled water to make the volume exactly 250 mils, mix well and filter through a dry filter. Evaporate 25 mils of the clear filtrate to dryness with 10 mils of nitric acid, dissolve the residue in 10 mils of distilled water, transfer it to a 100-mil flask with the aid of a few mils of distilled water, add a drop of phenolphthalein T.S. and sufficient sodium hydroxide T.S. (free from chloride) to produce a pink color, then add 50 mils of tenth-normal silver nitrate V.S. and agitate the mixture well. Now gradually add zinc oxide (free from chloride) in small portions, agitating vigorously after each addition until the liquid is neutral to litmus. Then add distilled water to make 100 mils, agitate the mixture thoroughly, filter through a dry filter, collect 50 mils of the filtrate, add 2 mils of nitric acid and 2 mils of ferric ammonium sulphate T.S., and titrate with tenth-normal potassium sulphocyanate V.S. to the production of a permanent red color. It shows not less than 97 per cent. of $Mn(PH_2O_2)_2+H_2O$. Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.003384 Gm. of $Mn(PH_2O_2)_2+H_2O$. Each gramme of Manganese Hypophosphite corresponds to not less than 286.6 mils of tenth-normal silver nitrate V.S.

N. F. Preparations.—Liquor Hypophosphitum Compositus; Syrupus Hypophosphitum Compositus.

Uses.—Used as a tonic and alterative in doses of three to five grains (0.2 to 0.32 Gm.).

MANGANI SULPHAS. N. F. Manganese Sulphate
(U. S. P. VIII)
[Mangan. Sulph.]

It contains not more than 38 per cent. of water, and not less than 62 per cent. nor more than 68 per cent. of $MnSO_4$ (151.00).

Preparation.—This rose-colored salt may be made by Prof. Diehl's process, by heating manganese dioxide and charcoal together to redness in a covered crucible until all of the charcoal is consumed, treating the residue, after cooling, with sulphuric acid, and evaporating to dryness, then returning the mixture to the covered crucible and again heating to redness; when cool, the residue is rubbed to powder, if necessary, and treated twice with eight parts of boiling water, the mixed liquors are filtered, evaporated until a pellicle forms, and set aside to crystallize.

In this process it is important that the dish containing the liquid which is set aside to crystallize be removed from the fire as soon as a pellicle begins to form, to prevent the formation of an insoluble sulphate.

Official Description.—It occurs as pale rose-colored, translucent, tetrahedral prisms slightly efflorescent when exposed to moist air.

Odor, Taste, and Reaction.—Odorless, taste slightly bitter and astringent. An aqueous solution of the salt (1 in 20) is neutral or slightly acid to litmus.

Solubility.—One gramme of the salt dissolves in about 1 mil of water at 25° C. (77° F.), and in about 0.6 mil of boiling water; insoluble in alcohol.

Tests for Identity.—It yields with ammonium sulphide T.S. a salmon-colored precipitate soluble in dilute acids; and with barium chloride T.S. a white precipitate insoluble in hydrochloric acid.

Mix a fragment of Manganese Sulphate with a small amount of sodium hydroxide and fuse the mixture; it yields a green mass which dissolves in water to form a green solution.

Impurities and Tests for Impurities.—*Iron.*—Add a few drops each of hydrochloric acid and of chlorine water to 20 mils of an aqueous solution of the salt (1 in 100), boil until the excess of chlorine is removed and then cool; it is not colored red by potassium sulphocyanate T.S.

Chloride.—The addition of a few drops of silver nitrate T.S. to 10 mils of an aqueous solution of the salt (1 in 100), previously mixed with a few drops of nitric acid, does not at once produce more than an opalescence.

Other Salts or Alkalies.—Precipitate the manganese completely from a solution of 1 Gm. of the salt in 50 mils of distilled water by the addition of ammonium carbonate T.S. and filter; the filtrate evaporated and gently ignited leaves a residue weighing not more than 0.005 Gm.

Zinc.—A solution of 1 Gm. of the salt and 1 Gm. of sodium acetate in 10 mils of distilled water, to which a few drops of acetic acid have been added, is not affected by hydrogen sulphide T.S.

Ignite 1 Gm. of the salt in a porcelain crucible; it loses not more than 38 per cent. of its weight (distinction from *Manganese Sulphate containing a larger amount of water of crystallization*).

Heavy Metals.—An aqueous solution of the salt, slightly acidulated with hydrochloric acid, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Dissolve about 0.6 Gm. of manganese sulphate, accurately weighed, in 100 mils of distilled water, add 10 mils of ammonia water and 30 mils of solution of hydrogen dioxide and boil the mixture until precipitation is complete. Transfer the mixture to a filter and wash the precipitate with distilled water until barium chloride T.S. ceases to produce a precipitate in the filtrate, then dry the filter and precipitate and incinerate these, first at a low heat and then at a strong red heat, until of constant weight. The weight of the residue of manganous-manganic oxide (Mn_3O_4) so obtained corresponds to not less than 31.3 per cent. nor more than 34.34 per cent. of the salt taken. Each gramme of manganous-manganic oxide is equivalent to 1.98 Gm. of $MnSO_4$.

N. F. Preparation.—Syrupus Ferri et Mangani Iodidi.

Uses.—Manganese sulphate is used as a cholagogue and tonic, in doses of three to twenty grains (0.2 to 1.3 Gm.). It is also used as a purgative when given in doses of from one to two drachms (4 to 8 Gm.) and may be administered by dissolving it in a flavored syrup.

POTASSI PERMANGANAS. U. S. Potassium Permanganate [Pot. Permang.]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99 per cent. of $KMnO_4$ (158.03). Preserve it in glass-stoppered bottles. Potassium Permanganate when in solution or in the dry condition must not be brought into contact with organic or other readily oxidizable substances.

This is the most important official compound of manganese. It is considered under the potassium compounds (page 731).

Iron. Fe; 55.84

Iron, the most useful and abundant of the metals, is widely diffused in nature; it is found not only in the mineral kingdom, but in animal and vegetable products as well.

Iron is a hard, malleable, ductile, and tenacious metal, of a grayish-white color and fibrous texture, a slightly styptic taste, having a sensible odor when rubbed. Its specific gravity is 7.8. It is combustible, and, when heated to whiteness, burns in atmospheric air, and with brilliant scintillations in oxygen. At a red heat its surface is converted into black oxide, and at common temperatures, by the combined agency of air and moisture, it becomes covered with a reddish matter, called *rust*, which is hydrated ferric oxide. It combines with all the non-metallic elements except hydrogen and nitrogen, and with most of the metals. It forms three compounds with oxygen,—ferrous and ferric oxide, which, by their union, form the native magnetic oxide, and a teroxide possessing acid properties, called ferric acid.

Tests for Iron Salts

1. Potassium *ferrocyanide* produces a nearly white precipitate with a ferrous salt, which rapidly turns blue on exposure to the air; with a ferric salt it strikes a deep blue color (Prussian blue) at once.

2. Potassium *ferricyanide* produces a deep blue color (Turnbull's blue) at once with a ferrous salt, and a greenish or olive color with a ferric salt.

3. Tannin does not change the color of a solution of ferrous salt, provided it has not been oxidized; with a ferric salt a dark greenish-black precipitate (ink) is produced.

4. Ammonium sulphide produces a black precipitate (sulphide) with either a ferrous or a ferric salt.

5. Ammonia water precipitates from ferrous salts, ferrous hydroxide, a white precipitate turning green, then black, and finally a brown color; the same reagent precipitates brown ferric hydroxide from ferric salts.

U. S. P. Salts and Solutions of Iron

Official Name	Preparation
Ferrum	Metallic iron in the form of fine, bright, and non-elastic wire
Reductum	Made by passing hydrogen over ferric oxide or hydroxide
Ferri Chloridum	By evaporating 100 Gm. of solution of ferric chloride to 40 Gm. and setting it aside to crystallize
Liquor Ferri Chloridi	By oxidizing solution of ferric chloride with nitric acid
Ferri et Ammonii Citras	By adding ammonia water to solution of ferric citrate, evaporating, and scaling
et Quininæ Citras	By adding ammonia water to a solution of iron and quinine citrate, evaporating, and scaling
Hydroxidum cum Magnesii Oxido	By mixing solution of ferric sulphate with magnesia and water

U. S. P. Salts and Solutions of Iron—*Continued*

Official Name	Preparation
Ferri Phosphas	By mixing solutions of ferric citrate and sodium phosphate, evaporating, and scaling
Sulphas	By treating iron with diluted sulphuric acid, evaporating, and crystallizing
Sulphas Exsiccatus	By exsiccating ferrous sulphate at a temperature of about 40° C. (104° F.)
Sulphas Granulatus	By cooling rapidly a hot, concentrated, aqueous solution of ferrous sulphate, stirring as crystallization occurs, collecting and drying the granulated salt
Liquor Ferri Subsulphatis	By heating ferrous sulphate in a mixture of sulphuric and nitric acids
Ferri Tersulphatis	By heating ferrous sulphate in a mixture of nitric and sulphuric acids, sulphuric acid being largely in excess

N. F. Salts and Solutions of Iron

Official Name	Preparation
Ferri Glycerophosphas	By adding a solution of ferric sulphate to solution of barium glycerophosphate, filtering and crystallizing the filtrate
Hypophosphis	Double decomposition between calcium hypophosphite and ferrous sulphate, filtering, and evaporating
Lactas	By digesting iron wire with lactic acid until neutral, filtering and crystallizing
Oxidum Saccharatum	See page 890 for the details of its preparation
Pyrophosphas	By mixing solutions of ferric citrate and sodium pyrophosphate, evaporating and scaling
Liquor Ferri Acetatis	By dissolving ferric hydroxide in glacial acetic acid
Ferri Albuminati	By dissolving freshly precipitated ferric albuminate with the aid of sodium citrate in a flavored vehicle
Ferri Citratis	By dissolving ferric hydroxide in a solution of citric acid
Ferri Hypophosphitis	A solution of ferric hypophosphite made with the aid of potassium citrate
Ferri Nitratis	By dissolving ferric hydroxide in nitric acid
Ferri Oxychloridi	A solution of ferric hydroxide in the presence of a trace of hydrochloric acid
Ferri Oxysulphatis	An oxidized solution of ferrous sulphate
Ferri Peptonati	By dissolving freshly precipitated ferric peptonate with the aid of sodium citrate, in a flavored vehicle
Ferri Peptonati et Mangani	Similar to the solution of peptonate of iron but with the addition of soluble manganese citrate
Ferri Protochloridi	An aqueous solution of ferrous chloride, prepared by acting upon iron with hydrochloric acid
Ferri Salicylatis	A flavored solution of freshly prepared ferric salicylate, rendered soluble by ammonium citrate and flavored.

Unofficial Salts and Preparations of Iron

Ferri Acetas, $Fe(C_2H_3O_2)_3$ Ferric Acetate	By dissolving ferric hydroxide in acetic acid, evaporating, then crystallizing
Ferri Arsenas, $3Fe(FeO)AsO_4 + 16H_2O$ Ferric Arsenate	By dissolving 1 oz. sodium arsenate and ¾ oz. sodium acetate in 8 oz. water, then dissolving 2 oz. ferrous sulphate in 10 fl. oz. water, mixing both solutions, collecting the precipitate, washing, and drying
Ferri Benzoas, $Fe(C_7H_5O_2)_3 + 3H_2O$ Ferric Benzoate	By adding to a solution of normal ferric sulphate a concentrated solution of sodium benzoate, collecting the precipitate, washing, and drying
Ferri Bromidum, $FeBr_2$ Ferrous Bromide	By adding 2 parts bromine to 1 part iron filings and 10 parts water, digesting until the liquid assumes a greenish color, then filtering and evaporating to dryness
Ferri et Sodii Pyrophosphas Iron and Sodium Pyrophosphate	By adding to a solution of 50 parts sodium pyrophosphate in 100 parts water sufficient ferric chloride in aqueous solution so that a permanent precipitate is not produced, then adding 250 parts alcohol and collecting the precipitate
Ferri et Strychninæ Citras, U. S. P. VIII Iron and Strychnine Citrate	By adding citric acid and strychnine to a solution of iron and ammonium citrate and scaling
Ferri et Ammonii Sulphas, U. S. P. VIII Ferric Ammonium Snlphate	By dissolving ammonium sulphate in solution of ferric sulphate, evaporating and crystallizing
Ferri et Ammonii Tartras, U. S. P. VIII Iron and Ammonium Tartrate	By dissolving ferric hydroxide in a solution of acid ammonium tartrate and scaling
Ferri et Potassii Tartras, U. S. P. VIII Iron and Potassium Tartrate	By adding acid potassium tartrate and a trace of ammonia water to ferric hydroxide, and scaling
Ferri Ferrocyanidum, $Fe_4(FeCN_6)_3$ Iron Ferrocyanide	By dissolving 4½ oz. potassium ferrocyanide in 1 pint water, adding the solution to 8 fl. oz. solution of normal ferric sulphate diluted previously with 8 fl. oz. water, stirring continually, collecting the precipitate, washing, and drying
Ferri Nitras, $Fe(NO_3)_3$ Ferric Nitrate	By concentrating a solution of ferric nitrate, filtering, and allowing to crystallize
Ferri Lactas, $Fe(C_3H_5O_3)_2 + 3H_2O$ Ferrous Lactate	By acting on iron with lactic acid and crystallizing the solution
Ferri Oxalas Ferrous Oxalate	By mixing solutions of ferrous sulphate and oxalic acid and collecting the precipitate

Unofficial Salts and Preparations of Iron—*Continued*

Ferri Oxidum Magneticum, Fe_3O_4 Magnetic Iron Oxide	By dissolving 2 oz. ferrous sulphate in 2 pints water and adding 5½ fl. oz. solution of normal ferric sulphate, then mixing this with 4 pints solution of sodium hydroxide, stirring well, boiling, letting it stand for 2 hours, occasionally stirring, collecting the precipitate, washing, and drying carefully
Ferri Oxidum Rubrum Red Oxide of Iron	By igniting ferrous sulphate in contact with air
Ferri Phosphas Albus, $FePO_4 + 4H_2O$ White Ferric Phosphate	By mixing 4 fl. oz. solution of normal ferric sulphate with a solution of 1 oz. sodium acetate, then adding solution of sodium phosphate, collecting the precipitate, washing, and drying
Ferri Salicylas Ferric Salicylate	By mixing a solution containing 24 grains of ferrous sulphate and 20 grains of sodium acetate in half a fluidounce of water with a solution made by dissolving 30 grains of sodium salicylate in half a fluidounce of water. Dose, a teaspoonful
Ferri Subcarbonas Ferric Oxyhydrate	By mixing solutions of 8 oz. ferrous sulphate and 9 oz. sodium carbonate, collecting the precipitate, washing and drying without heat
Ferri Sulphidum, FeS Ferrous Sulphide	By mixing 3 parts iron filings with 2 parts sublimed sulphur, then placing in small portions the above mixture into a crucible heated to redness, and keeping covered after each addition
Ferri Valeras Ferric Valerate	By double decomposition between ferric sulphate and sodium valerate

FERRUM. U. S. Iron

[Ferr.]

Metallic iron [Fe = 55.84] in the form of fine, bright wire.

Iron, when employed in pharmaceutical operations, should be of the purest kind; hence the pharmacopœias generally direct it, when wanted in small masses, to be in the form of *iron wire*, which is necessarily made from the purest iron, because it is the softest and most ductile, and readily cut into pieces. Such wire is very flexible and without elasticity.

The wire clippings and the ends of card teeth obtained from the manufacturers of cotton carding machines are frequently used in Philadelphia for making iron preparations. They are very convenient; and it may be incidentally mentioned that they are sometimes used as a substitute for sand, in sand baths. Iron scraps and waste from steel pen factories are also used to make preparations of iron.

U. S. P. Preparations.—Liquor Ferri Chloridi; Syrupus Ferri Iodidi.

N. F. Preparations.—Liquor Ferri Protochloridi; Syrupus Calcii Iodidi; Syrupus Ferri et Mangani Iodidi.

FERRUM REDUCTUM. U. S. Reduced Iron

[**Ferr. Reduct.**—FERRUM REDUCTUM IRON BY HYDROGEN QUEVENNE'S IRON]

Iron reduced to the metallic state by the action of hydrogen upon ferric oxide. It contains not less than 90 per cent. of metallic iron [Fe = 55.84]. Preserve it in well-closed containers.

Preparation.—Reduced iron may be made by a process originally proposed by Prof. Procter, and afterwards made official in 1870:

Take of ferric oxide (Fe_2O_3) 30 oz. troy. Wash the oxide thoroughly with water until no traces of sodium sulphate are indicated by the appropriate tests, and calcine it in a shallow vessel until free from moisture. Then spread it upon a tray, made by bending an oblong piece of sheet-iron in the form of an incomplete cylinder, and introduce this into a wrought-iron reduction tube, about four inches in diameter. Place the reduction tube in a charcoal furnace, and, by means of a self-regulating generator of hydrogen, pass through it a stream of that gas, previously purified by bubbling successively through solution of lead subacetate, diluted with three times its volume of water, and through milk of lime, severally contained in four-pint bottles about one-third filled. Connect with the further extremity of the reduction tube a lead tube bent so as to dip into water. Make all the junctions airtight by appropriate lutes; and, when the hydrogen has passed long enough to fill the whole of the apparatus to the exclusion of atmospheric air, light the fire, and bring that part of the reduction tube, occupied by the subcarbonate, to a dull-red heat, which must be kept up so long as the bubbles of hydrogen, breaking from the water covering the orifice of the lead tube, are accompanied by visible aqueous vapor. When the reduction is completed, remove the fire, and allow the whole to cool to the ordinary temperature, keeping up, during the refrigeration, a moderate current of hydrogen through the apparatus. Withdraw the product from the reduction tube, and, should any portion of it be black instead of iron-gray, separate such portion for use in a subsequent operation. Lastly, having powdered the Reduced Iron, keep it in a well-stoppered bottle. When thirty troyounces of subcarbonate of iron are operated on, the process occupies from five to eight hours.

The ferric oxide directed in the above formula was at one time called iron subcarbonate. The hydrogen combines with the oxygen to form water, metallic iron, in fine powder, being left.

$$\underset{\text{Ferric Oxide}}{Fe_2O_3} + \underset{\text{Hydrogen}}{6H} = \underset{\text{Iron}}{2Fe} + \underset{\text{Water}}{3H_2O}$$

Official Description.—It occurs as a very fine, grayish-black, lusterless powder: permanent in dry air.

Odor, Taste, and Reaction.—Without odor or taste. Shake 1 Gm. of Reduced Iron with 5 mils of distilled water and filter; the liquid does not change the color of litmus.

Solubility.—Reduced Iron is insoluble in water or alcohol.

Tests for Identity.—When ignited in contact with air, it glows and is converted into black ferroso-ferric oxide.

Impurities and Tests for Impurities.—*Sulphide.*—One Gm. of Reduced Iron, when treated with 20 mils of diluted sulphuric acid in a flask, causes the evolution of nearly odorless hydrogen gas, which does not affect paper moistened with lead acetate T.S. within two minutes, and, on applying a gentle heat, the Iron dissolves in the acid without leaving more than 1 per cent. of residue.

Arsenic.—Add 20 mils of diluted sulphuric acid to 0.5 Gm. of Reduced Iron contained in a small, covered beaker, and, after the reaction has somewhat subsided, warm the liquid on a water bath until the reaction ceases. Collect any minute, undissolved residue upon a very small filter, rinse the beaker with distilled water, add the rinsings to the filter, and then wash the residue with distilled water until free from acid reaction. Transfer the residue to the beaker by rinsing it back, and, after adding about 0.25 Gm. of potassium chlorate and 5 mils of hydrochloric acid, slowly evaporate the solution to dryness on a water bath. Dissolve the residue in sufficient distilled water to measure 50 mils, and add 5 mils of this solution to 5 mils of a saturated solution of sulphurous acid and heat the liquid on a water bath for fifteen minutes, or until all traces of sulphurous acid have been removed. The resulting solution meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Assay.—Introduce into a 100-mil flask about 1 Gm. of Reduced Iron, previously well triturated and accurately weighed, and add 10 Gm. of finely powdered mercuric chloride and 50 mils of boiling distilled water. Boil the mixture for five minutes, shaking it frequently, then fill the flask to the 100-mil mark with distilled water, recently boiled and cooled, and cool it to room temperature. Again fill the flask to the mark with distilled water, stopper, agitate the contents well, and allow it to stand for a few minutes. Now filter the contents of the flask and immediately titrate 20 mils of the filtrate to which has been added 20 mils of diluted sulphuric acid, with tenth-normal potassium permanganate V.S., until a permanent pink color is produced. It shows not less than 90 per cent. of Fe when calculated from the original weight of Reduced Iron taken. Each mil of tenth-normal potassium permanganate V.S. used corresponds to 0.005584 Gm. of Fe. Each gramme of Reduced Iron corresponds to not less than 161.2 mils of tenth-normal potassium permanganate V.S.

U. S. P. Preparation.—Pilulæ Ferri Iodidi.

N. F. Preparations.—Extractum Ferri Pomatum; Pilulæ Ferri, Quininæ, Strychninæ et Arseni Fortiores; Pilulæ Ferri, Quininæ, Strychninæ et Arseni Mites.

Uses.—Powder of iron, or reduced iron, is one of the best of the chalybeate tonics. It is generally given in pill form, in doses of one to six grains (0.065 to 0.38 Gm.). It has been used for the preparation of syrup of ferrous iodide, replacing the iron wire and hastening the reaction. An excellent form of administering it is in combination with chocolate in the form of lozenges.

FERRI CARBONAS SACCHARATUS. U. S. Saccharated Ferrous Carbonate

[Ferr. Carb. Sacch.]

Saccharated Ferrous Carbonate contains not less than 15 per cent. of $FeCO_3$ (115.84). Preserve it in small, well-stoppered bottles, exposed to light.

	Metric	Old form
***Ferrous Sulphate**	**50 Gm.**	5 oz. av.
Sodium Bicarbonate	**35 Gm.**	3½ oz. av.
Sugar of Milk	**10 Gm.**	1 oz. av.
Sugar, in fine powder,		
Diluted Sulphuric Acid,		
Distilled Water, each, a sufficient quantity,		
To make	**100 Gm.**	10 oz. av.

Dissolve the ferrous sulphate in 200 mils [old form 20 fl. oz.] of hot distilled water, add a few drops of diluted sulphuric acid and filter. Dissolve the sodium bicarbonate in 500 mils [old form 3 pints] of distilled water at a temperature not exceeding 50° C. (122° F.), and filter. To the solution of sodium bicarbonate, contained in a flask having a capacity of about 1000 mils [old form 6 pints], gradually add the solution of ferrous sulphate, and mix thoroughly by rotating the flask. Fill the flask with boiling distilled water, cork it loosely, and set the mixture aside. When the precipitate has subsided, draw off the clear supernatant liquid by means of a siphon; fill the flask again with hot distilled water and shake it. Again draw off the clear liquid, and repeat the washing with hot distilled water, in the same manner, until the decanted liquid gives merely a slight cloudiness with barium chloride T.S. Drain the precipitate, and transfer it to a porcelain dish containing 70 Gm. [old form 7 oz. av.] of sugar and 10 Gm. [old form 1 oz. av.] of sugar of milk and mix intimately. Evaporate the mixture to dryness on a water bath, reduce it to powder, weigh, and mix intimately with it, if necessary, enough well-dried sugar to make the product weigh 100 Gm. [old form 10 oz. av.]. To minimize oxidation make this preparation in the shortest possible time.

In this preparation ferrous carbonate is formed, sodium sulphate remaining in solution. Sodium bicarbonate is preferred because the evolution of carbonic acid during the decomposition measurably prevents oxidation; it would have been an improvement to use syrup in the solutions to protect them still further.

The object of boiling the water that is used in washing is to expel the air, so that the ferrous carbonate may escape its oxidizing action; the evaporation of the mixture should be conducted as rapidly as possible, for the same reason.

$$\begin{array}{ccccccccccc} FeSO_4 & + & 2NaHCO_3 & = & Na_2SO_4 & + & FeCO_3 & + & H_2O & + & CO_2 \\ \text{Ferrous} & & \text{Sodium} & & \text{Sodium} & & \text{Ferrous} & & \text{Water} & & \text{Carbon} \\ \text{Sulphate} & & \text{Bicarbonate} & & \text{Sulphate} & & \text{Carbonate} & & & & \text{Dioxide} \end{array}$$

Official Description.—It is a greenish-brown powder, gradually becoming oxidized by contact with air.

Odor and Taste.—Odorless, and having at first a sweetish, afterwards slightly ferruginous taste.

Solubility.—Saccharated Ferrous Carbonate is only partially soluble in water, but is completely dissolved on the addition of hydrochloric acid, with copious evolution of carbon dioxide, forming a clear, greenish-yellow liquid.

Tests for Identity.—Dissolve 1 Gm. of Saccharated Ferrous Carbonate in 5 mils of hydrochloric acid, and dilute the solution with distilled water until it measures 100 mils. Portions of this solution yield a blue precipitate with either potassium ferrocyanide T.S. or potassium ferricyanide T.S.

Impurities and Tests for Impurities.—*Sulphate*—Another 10-mil portion of the solution just prepared shows not more than a slight turbidity with barium chloride T.S.

Assay.—Dissolve about 2 Gm. of Saccharated Ferrous Carbonate, accurately weighed, in 15 mils of diluted sulphuric acid, and dilute the solution with distilled water to about 100 mils. Titrate immediately with tenth-normal potassium dichromate V.S., potassium ferricyanide T.S. being used as indicator. It shows not less than 15 per cent. of $FeCO_3$. Each mil of tenth-normal potassium dichromate V.S. used corresponds to 0.011584 Gm. of $FeCO_3$. Each gramme of Saccharated Ferrous Carbonate corresponds to not less than 13 mils of tenth-normal potassium dichromate V.S.

Uses.—Saccharated ferrous carbonate is used as a tonic, in doses of four to thirty grains (0.25 to 2 Gm.).

MASSA FERRI CARBONATIS. U. S. Mass of Ferrous Carbonate

[Mass. Ferr. Carb.—VALLET'S MASS]

It contains not less than 35 per cent. of $FeCO_3$ (115.84).

	Metric	Old form
***Ferrous Sulphate**	**00 Gm.**	8 oz. av.
Monohydrated Sodium Carbonate	**46 Gm.**	3 oz. av. 5 dr.
Clarified Honey	**38 Gm.**	3 oz. av.
Sugar, in coarse powder	**25 Gm.**	2 oz. av.
Syrup,		
Distilled Water, each, a sufficient quantity,		
To make	**100 Gm.**	8 oz. av.

Dissolve the ferrous sulphate and the monohydrated sodium carbonate, each separately, in 200 mils [old form 1 pint] of boiling distilled water, and, having added 20 mils [old form 1½ fl. oz.] of syrup to the solution of the iron salt, filter both solutions, and allow them to become cold. Place the solution of monohydrated sodium carbonate in a bottle having a capacity of about 500 mils [old form 3 pints], and gradually add the solution of the iron salt, rotating the bottle frequently, until carbonic acid gas no longer escapes. Add sufficient distilled water to fill the bottle; then cork it and set it aside, so that the ferrous carbonate may subside. Pour off the supernatant liquid, and, having mixed syrup and distilled water in the proportion of one volume of syrup to nineteen volumes of distilled water, wash the precipitate with the mixture by decantation until the washings no longer have a saline taste. Drain the precipitate on a muslin strainer, and express as much of the water as possible. Lastly, mix the precipitate at once with the clarified honey and sugar, and, by means of a water bath, evaporate the mixture in a tared dish, with constant stirring, until it is reduced to 100 Gm. [old form 8 oz. av.].

Assay.—Dissolve about 1 Gm. of Mass of Ferrous Carbonate, accurately weighed, in 15 mils of diluted sulphuric acid, dilute the solution with distilled water to about 100 mils and immediately titrate with tenth-normal potassium dichromate V.S., potassium ferricyanide T.S. being used as indicator. It shows not less than 35 per cent. of $FeCO_3$. Each mil of tenth-normal potassium dichromate V.S. used corresponds to 0.011584 Gm. of $FeCO_3$. Each gramme of Mass of Ferrous Carbonate corresponds to not less than 30.2 mils of tenth-normal potassium dichromate V.S.

This preparation consists of ferrous carbonate preserved from oxidation by contact with syrup and honey. The reaction is as follows:

$$\underset{\text{Ferrous Sulphate}}{FeSO_4} + \underset{\text{Sodium Carbonate}}{Na_2CO_3} = \underset{\text{Ferrous Carbonate}}{FeCO_3} + \underset{\text{Sodium Sulphate}}{Na_2SO_4}$$

Uses.—Mass of ferrous carbonate is widely known as *Vallet's mass;* it is a valuable chalybeate tonic, and is administered in pill form, in doses of four to fifteen grains (0.25 to 1 Gm.). Ferrous carbonate is also official in the U. S. P. under the title *Pilulæ Ferri Carbonatis,* see Chapter LXVII.

FERRI CHLORIDUM. U. S. Ferric Chloride

[Ferr. Chlor.—IRON PERCHLORIDE SESQUICHLORIDE OF IRON]

It contains $FeCl_3$ (162.22) in a hydrated form corresponding to not less than 20 per cent. of Fe. Preserve it in well-closed glass containers.

Preparation.—The U. S. P. IX did not include a process for its manufacture, but the U. S. P. VIII process was as follows:

	Metric	Old form
Solution of Ferric Chloride	**100 Gm.**	10 oz. av.
To make..............................	**40 Gm.**	4 oz. av.

Evaporate the solution of ferric chloride on a water bath until it weighs 40 Gm. [old form 4 oz. av.]; then set it aside in a glass-covered vessel until it forms a crystalline mass. Lastly, break the salt into pieces, and keep it in glass-stoppered bottles, protected from light.

Official Description.—It occurs in orange-yellow, crystalline pieces. It is very deliquescent in air.

Odor and Taste.—Odorless, or with a faint odor of hydrochloric acid, and having a strongly styptic taste.

Solubility.—One Gm. of Ferric Chloride dissolves in 0.2 mil of water at 25° C. (77° F.); freely soluble in alcohol and soluble in glycerin or ether.

Tests for Identity.—At about 35.5° C. (96° F.) the salt fuses to a reddish-brown liquid. When strongly heated, it decomposes, losing some ferric chloride, water and hydrochloric acid and leaving a residue of ferric oxide.

Impurities and Tests for Impurities.—An aqueous solution of Ferric Chloride, made by dissolving 10 Gm. of the salt in 15 mils of distilled water, responds to the tests for identity and purity under *Liquor Ferri Chloridi*, omitting the test for hydrochloric acid.

Assay.—Dissolve about 1 Gm. of Ferric Chloride, accurately weighed in a stoppered weighing-bottle, in 25 mils of distilled water, add 3 mils of hydrochloric acid and 4 Gm. of potassium iodide, and allow the mixture to stand in a glass-stoppered flask or bottle for thirty minutes at a temperature of 40° C. (104° F.). Cool this solution, then dilute it with 100 mils of distilled water and titrate with tenth-normal sodium thiosulphate V.S., using starch T.S. as indicator. It shows not less than 20 per cent. of Fe. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.005584 Gm. of Fe. Each gramme of Ferric Chloride corresponds to not less than 35.8 mils of tenth-normal sodium thiosulphate V.S.

Uses.—Ferric chloride is used externally as a styptic, and internally as a chalybeate tonic, in doses of one to five grains (0.065 to 0.32 Gm.)

LIQUOR FERRI CHLORIDI. U. S. Solution of Ferric Chloride

[Liq. Ferr. Chlor.—SOLUTION OF IRON PERCHLORIDE]

An aqueous solution containing ferric chloride [$FeCl_3 = 162.22$], corresponding to not less than 10 per cent. nor more than 11 per cent. of Fe. Preserve it in glass-stoppered bottles protected from light.

	Metric	Old form
***Iron,** in the form of fine, bright wire, and cut into small pieces	**125 Gm.**	2 oz. av. 325 gr.
Hydrochloric Acid	**680 Gm.**	12 fl. oz. 3 fl. dr.
Nitric Acid,		
Distilled Water, each, a sufficient quantity,		
To make	**1000 Gm.**	1 pint

Introduce the iron wire into a flask having a capacity of about 2000 mils [old form 3 pints], pour upon it a mixture of 420 Gm. [or measure, old form 7 fl. oz. 7 fl. dr.] of hydrochloric acid and 250 mils [old form 5½ fl. oz.] of distilled water and heat the mixture on a water bath for not less than one hour and fifteen minutes, or until effervescence ceases; then boil the liquid, filter it through paper, and, having rinsed the flask and iron wire with a little hot distilled water, pass the rinsing through the filter. To the filtered liquid add 220 Gm. [or measure, old form 4 fl. oz.] of hydrochloric acid, then add the mixture slowly and gradually in a stream to 65 Gm. [or measure, old form 468 minims] of nitric acid contained in a tared, capacious porcelain vessel, and warm gently. If the solution has acquired a black color, continue the addition of nitric acid, drop by drop, until red fumes are no longer evolved and the solution assumes a clear, reddish-brown color. After effervescence ceases, heat on a sand bath, stirring occasionally until the liquid is free from nitric acid, as indicated by the test given below. During the heating add distilled water from time to time to maintain about the original volume. Finally add the remaining 40 Gm. [or measure, old form 6 fl. oz.] of hydrochloric acid and enough distilled water to make the Solution weigh 1000 Gm. [or measure, old form 1 pint].

In the first step of the process, ferrous chloride is produced; thus:

$$\underset{\text{Iron}}{Fe_2} + \underset{\substack{\text{Hydrochloric}\\\text{Acid}}}{4HCl} = \underset{\substack{\text{Ferrous}\\\text{Chloride}}}{(FeCl_2)_2} + \underset{\text{Hydrogen}}{4H}$$

Ferrous chloride is converted into ferric chloride by the addition of nitric and hydrochloric acids; thus:

$$\underset{\text{Ferrous Chloride}}{6FeCl_2} + \underset{\text{Hydrochloric Acid}}{6HCl} + \underset{\text{Nitric Acid}}{2HNO_3} = \underset{\text{Ferric Chloride}}{6FeCl_3} + \underset{\text{Nitrogen Dioxide}}{N_2O_2} + \underset{\text{Water}}{4H_2O}$$

If this solution, when finished, has a black color, it is due to incomplete oxidation, and the remedy is to heat it to boiling in a capacious dish, adding a few drops of nitric acid until the color changes to a clear ruby-red and effervescence ceases. If a brown precipitate is deposited upon dilution or standing, deficiency of hydrochloric acid is indicated, and the solution must be heated, and a few drops of the acid added until the precipitate is dissolved; but a large excess of hydrochloric acid must be avoided or the solution will prove unsatisfactory in the preparation of tincture of ferric citro-chloride of the N. F. (see page 501), producing a reddish instead of a green colored solution. The U. S. P. IX has included a test to limit the amount of free acid.

Official Description.—It is a reddish-brown liquid.

Odor, Taste, and Reaction.—Having a faint odor of hydrochloric acid, an acid, strongly styptic taste, and an acid reaction.

Specific Gravity.—From 1.29 to 1.32 at 25° C. (77° F.).

Tests for Identity.—Separate portions of an aqueous dilution of the Solution (1 in 10) yield a brownish-red precipitate with ammonia water, a blue precipitate with potassium ferrocyanide T.S., and a white precipitate, insoluble in nitric acid, with silver nitrate T.S.

Impurities and Tests for Impurities.—*Zinc, Lead or Copper.*—Precipitate the iron completely from a weighed portion of about 2 mils of the Solution, previously diluted with 50 mils of distilled water, by adding an excess of ammonia water and filter. The filtrate is colorless, and does not yield a precipitate with hydrogen sulphide T.S.

Salts of the Fixed Alkalies.—Nor does it leave on evaporation and ignition a fixed residue corresponding to more than 0.1 per cent. of the amount taken.

Nitric Acid.—Add a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of sulphuric acid and an aqueous dilution of the Solution (1 in 10); the crystal does not become brown nor does a brownish-black color develop around it.

Ferrous Salts.—Add a few drops of freshly prepared potassium ferricyanide T.S. to an aqueous dilution of the Solution (about 1 in 20); a brown color is produced which does not at once turn green or greenish-blue.

Free Hydrochloric Acid.—To about 0.5 Gm. of Solution of Ferric Chloride, accurately weighed, add 10 mils of distilled water and 50 mils of tenth-normal silver nitrate V.S., shake it vigorously, then add 2 mils of nitric acid and sufficient distilled water to measure exactly 100 mils, and mix well. Filter the mixture through a dry filter (rejecting the first filtrate) and determine the excess of silver nitrate in 50 mils of the filtrate by titration with tenth-normal potassium sulphocyanate V.S. The percentage of chlorine found is not less than 3 per cent. nor more than 5 per cent. in excess of that required to combine with the iron present as ferric chloride. The percentage of iron found, multiplied by 1.9, gives the percentage of chlorine combined as ferric chloride. Each mil of tenth-normal silver nitrate V.S. corresponds to 0.003546 Gm. of Cl.

Assay.—Transfer about 2 Gm. of Solution of Ferric Chloride to a tared flask, stopper and weigh accurately, then add 5 mils of hydrochloric acid, 25 mils of distilled water and about 3 Gm. of potassium iodide, securely stopper the flask and allow the mixture to stand for thirty minutes at a temperature of 40° C. (104° F.). Cool the liquid, dilute it with 100 mils of distilled water and then titrate with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator. It shows not less than 10 per cent. nor more than 11 per cent. of Fe. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.005584 Gm. of Fe. Each gramme of Solution of Ferric Chloride corresponds to not less than 17.9 mils nor more than 19.7 mils of tenth-normal sodium thiosulphate V.S.

U. S. P. Preparations.—Ferri Chloridum; Tinctura Ferri Chloridi.

N. F. Preparations.—Ferri Oxidum Saccharatum; Gossypium Stypticum; Liquor Ferri Oxychloridi; Tinctura Ferri Chloridi Ætherea; Tinctura Ferri Citro-Chloridi.

Uses.—This solution is occasionally used as a hæmostatic; its principal use, however, is to form, by dilution with alcohol, the well-known tincture of ferric chloride. The dose is from one to two minims (0.06 to 0.12 mil).

TINCTURA FERRI CHLORIDI. U. S. Tincture of Ferric Chloride

A hydro-alcoholic solution containing ferric chloride [$FeCl_3 = 162.22$] (about 13 per cent.), corresponding to not less than 4.48 per cent. of Fe. Protect tincture of ferric chloride from light.

This tincture is made by diluting 350 mils of solution of ferric chloride with 650 mils of alcohol, the mixture to stand in a closely covered vessel at least three months; it is then to be transferred to glass-stoppered bottles (see page 479). The object of allowing the mixture to stand three months before it is to be used is to permit the formation of ethyl chloride and other similar ethereal compounds, the result of the action of the free acid on the alcohol. These esters are supposed to give to the tincture diuretic properties. If a brownish-red precipitate of ferric oxychloride takes place upon diluting the solution of ferric chloride, it shows that the solution has not been properly made, and is deficient in free hydrochloric acid (see above).

Official Description.—A bright, amber-colored liquid.

Odor, Taste, and Reaction.—Having a slightly ethereal odor, a very astringent, styptic taste, and an acid reaction.

Specific Gravity.—About 1.00 at 25° C. (77° F.).

Tests for Identity.—The Tincture yields a brownish-red precipitate with ammonia water, a blue precipitate with potassium ferrocyanide T.S., and a white precipitate, insoluble in nitric acid, with silver nitrate T.S.

After the Tincture has been exposed for some time to daylight, it yields a greenish or greenish-blue color with potassium ferricyanide T.S. (presence of some *ferrous salt*, due to reduction).

Impurities and Tests for Impurities.—*Nitric Acid.*—Add a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and a diluted portion of the Tincture (1 in 10); the crystal does not become brown, nor is a brownish-black zone developed around it.

Assay.—Evaporate to dryness in a porcelain dish on a water bath about 5 mils of Tincture of Ferric Chloride, accurately weighed in a tared weighing-bottle. Add 2 mils of hydrochloric acid and 5 mils of solution of hydrogen dioxide to the residue and again evaporate the mixture to dryness. Dissolve this residue in 25 mils of distilled water, transfer the solution to a 250-mil glass-stoppered flask, mix it with 3 mils of hydrochloric acid and about 1 Gm. of potassium iodide, and allow the mixture to stand for thirty minutes at a temperature of 40° C. (104° F.). Cool the solution, add 100 mils of distilled water and titrate the liberated iodine with tenth-normal sodium thiosulphate V.S. It shows not less than 4.48 per cent. of Fe. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.005584 Gm. of Fe. Each gramme of tincture of Ferric Chloride corresponds to not less than 8 mils of tenth-normal sodium thiosulphate V.S.

Uses.—Tincture of ferric chloride is undoubtedly one of the most important liquid iron preparations that is used; it is an efficient chalybeate tonic and styptic. The dose is from eight to thirty minims (0.5 to 2 mils), diluted with water; it should be drawn through a glass tube, to prevent injury to the teeth.

FERRI ET AMMONII CITRAS. U. S. Iron and Ammonium Citrate

[**Ferr. et Ammon. Cit.**—SOLUBLE FERRIC CITRATE AMMONIO-FERRIC CITRATE]

Ferric citrate rendered more readily soluble by the presence of ammonium citrate and containing not less than 16 per cent. nor more than 18 per cent. of Fe. Preserve it in well-closed containers, protected from light.

Preparation.—Iron and Ammonium Citrate may be made by the official process of 1890, in which a mixture of 100 mils of solution of ferric citrate and 40 mils of ammonia water were evaporated at a temperature not exceeding 60° C. (140° F.) to the consistence of syrup, and spread on glass plates to dry.

Prof. J. U. Lloyd modifies this process with advantage by using, instead of ammonia water, a definite quantity of ammonium citrate in solution (see U. S. Dispensatory, 19th edition, page 497).

Official Description.—It occurs as thin, transparent, garnet-red scales. It is deliquescent in moist air.

Odor, Taste, and Reaction.—Odorless and having a saline, mildly ferruginous taste. An aqueous solution (1 in 20) is neutral or but slightly acid or alkaline to litmus.

Solubility.—Iron and Ammonium Citrate is readily and completely soluble in water; insoluble in alcohol.

Tests for Identity.—When strongly heated, it chars, and finally leaves a residue of ferric oxide.

Heat Iron and Ammonium Citrate with potassium hydroxide T.S.; it yields a brownish-red precipitate, and ammonia is evolved.

Ammonia water, added to an aqueous solution, produces no precipitate, but darkens the solution.

Impurities and Tests for Impurities.—*Tartrate.*—Remove the iron from 10 mils of an aqueous solution of Iron and Ammonium Citrate (1 in 10) by boiling it with an excess of potassium hydroxide T.S., filter, and then slightly acidulate the filtrate with acetic acid. A portion of the cooled filtrate, when mixed with 2 mils of calcium chloride T.S., and again heated to boiling, gradually deposits a white crystalline precipitate. Another portion of the filtrate, when acidulated more strongly with acetic acid and allowed to stand for twenty-four hours, does not yield a white crystalline precipitate.

An aqueous solution of Iron and Ammonium Citrate (1 in 100) does not yield a blue precipitate with potassium ferrocyanide T.S. unless it is acidulated with hydrochloric acid (difference from *ferric citrate*).

Assay.—Dissolve about 1 Gm. of Iron and Ammonium Citrate, accurately weighed, in 25 mils of distilled water and 7 mils of hydrochloric acid, in a glass-stoppered flask or bottle, add 4 Gm. of potassium iodide, stopper the bottle securely and keep it at a temperature of 40° C. (104° F.) for thirty minutes. Then cool, and titrate with tenth-normal sodium thiosulphate V.S., using starch T.S. as indicator. It shows not less than 16 per cent. nor more than 18 per cent. of Fe. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.005584 Gm. of Fe. Each gramme of Iron and Ammonium Citrate corresponds to not less than 28.6 mils nor more than 32.2 mils of tenth-normal sodium thiosulphate V.S.

N. F. Preparations.—Vinum Carnis et Ferri; Vinum Ferri.

Uses.—Iron and ammonium citrate is a useful modification of ferric citrate, the object of adding the ammonia water being to make the salt more quickly soluble. The dose is four to twenty grains (0.25 to 1.3 Gm.).

FERRI ET QUININÆ CITRAS. U. S. Iron and Quinine Citrate

[**Ferr. et Quin. Cit.**—FERRI ET QUININÆ CITRAS SOLUBILIS, U. S. P. VIII
SOLUBLE IRON AND QUININE CITRATE]

Iron citrate and quinine citrate rendered more soluble by the presence of ammonium citrate and containing not less than 11.5 per cent. of anhydrous quinine ($C_{20}H_{24}O_2N_2$) and not less than 13 per cent. of Fe. Preserve it in amber-colored, well-stoppered bottles protected from light.

Preparation.—The process of the U. S. P. 1890 is appended, no process being given for this scaled salt in the U. S. P. IX.

	Metric	Old form
Ferric Citrate	85 Gm.	13 oz. av. 262 gr.
Quinine, dried at 100° C. (212° F.) to a constant weight	12 Gm.	1 oz. av. 400 gr.
Citric Acid	3 Gm.	210 gr.
Ammonia Water,		
Distilled Water, each, a sufficient quantity,		
To make	100 Gm.	16 oz. av.

Dissolve the ferric citrate in 160 mils [old form 26 fl. oz.] of distilled water, by heating on a water bath at a temperature not exceeding 60° C. (140° F.). To this solution add the quinine and citric acid previously triturated with 20 mils [old form 3½ fl. oz.] of distilled water, and stir constantly until the quinine and citric acid are dissolved. Then add gradually, and with constant stirring, 50 mils [old form 8 fl. oz.], or a sufficient quantity, of ammonia water, so that, after the addition of each portion of the latter, the precipitated quinine will be redissolved and the liquid acquire a greenish-yellow tint. Lastly, evaporate the solution on a water bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales.

Official Description.—It occurs as thin, transparent scales, of a greenish or golden-yellow color. It is deliquescent.

Odor, Taste, and Reaction.—Odorless, and having a bitter, mildly ferruginous taste. An aqueous solution (1 in 10) is acid to litmus.

Solubility.—Iron and Quinine Citrate is rapidly and completely soluble in cold water; partly soluble in alcohol.

Tests for Identity.—When strongly heated, Iron and Quinine Citrate chars, and finally leaves a residue of ferric oxide.

When heated with potassium hydroxide T.S., a brown precipitate is produced and ammonia is evolved.

On the addition of a slight excess of ammonia water to an aqueous solution of Iron and Quinine Citrate (1 in 10), the color of the liquid is deepened, and a white, curdy precipitate is produced.

A portion of the filtrate from this precipitate does not yield a blue color or precipitate with potassium ferrocyanide T.S. unless it is acidulated with hydrochloric acid.

Impurities and Tests for Impurities.—*Tartrate.*—Boil an aqueous solution of Iron and Quinine Citrate (1 in 10) with an excess of potassium hydroxide T.S. until completely precipitated, and slightly acidulate the filtrate with acetic acid. A portion of the cooled filtrate, mixed with 2 mils of calcium chloride T.S. and again heated to boiling, gradually deposits a white, crystalline precipitate. Another portion of the filtrate, more strongly acidulated with acetic acid and allowed to stand for twenty-four hours, does not yield a white, crystalline precipitate.

Assay for Quinine.—Dissolve about 1 Gm. of Iron and Quinine Citrate, accurately weighed, in 20 mils of distilled water in a separator, add 5 mils of ammonia water and 10 mils of chloroform, and shake the separator for one minute. Allow the liquids to separate, draw off the chloroform layer through a small filter moistened with chloroform, into a tared dish, and shake the residuary liquid a second and a third time with portions of 10 mils each of chloroform, passing the chloroform through the filter each time and finally washing the filter with 5 mils of chloroform. Evaporate the combined chloroform solutions, redissolve the residue in 3 mils of alcohol, again evaporate and then dry the residue to constant weight at 100° C. (212° F.). This residue corresponds to not less than 11.5 per cent. of the amount of Iron and Quinine Citrate taken for the assay and conforms to the identity tests under *Quinina.*

Assay for Iron.—Heat the aqueous liquid, from which the quinine has been removed in the manner just described, on a water bath until the odors of chloroform and of ammonia have disappeared, allow to cool and dilute with distilled water to a volume of 25 mils. Transfer the liquid to a glass-stoppered bottle, add 15 mils of hydrochloric acid and 3 Gm. of potassium iodide, and, after securely closing the bottle, allow the mixture to stand for thirty minutes at 40° C. (104° F.). Then cool and titrate with sodium thiosulphate V.S., using starch T.S. as indicator. It shows not less than 13 per cent. of Fe. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.005584 Gm. of Fe. Each gramme of Iron and Quinine Citrate corresponds to not less than 23.3 mils of tenth-normal sodium thiosulphate V.S.

N. F. Preparation.—Vinum Ferri Amarum.

Uses.—This is the soluble form of iron and quinine citrate, and is preferred by pharmacists when solutions are needed quickly.

FERRI HYDROXIDUM CUM MAGNESII OXIDO. U. S. Ferric Hydroxide with Magnesium Oxide

[**Ferr. Hydrox. cum Mag. Oxid.**—ARSENIC ANTIDOTE FERRIC HYDRATE WITH MAGNESIA]

	Metric	Old form
***Solution of Ferric Sulphate**	**40 mils**	**1 fl. oz. 3 fl. dr.**
Magnesium Oxide	**10 Gm.**	**154 gr.**
Water, a sufficient quantity.		

Mix the solution of ferric sulphate with 125 mils [old form about 4 fl. oz.] of water, and keep the liquid in a large, well-stoppered bottle. Rub the magnesium oxide with cold water to a smooth and thin mixture, transfer this to a bottle capable of holding about 1000 mils [old form 2 pints], fill it with water to about three-fourths of its capacity, and keep it tightly stoppered. When the preparation is wanted for use, shake the magnesium oxide mixture until of a thin, creamy consistence, slowly add to it the diluted solution of ferric sulphate, and shake them together until a uniformly smooth mixture results.

NOTE.—In this process the 10 Gm. [old form 154 grains] of magnesium oxide may be replaced by 300 mils [old form 10 fl. oz. 69 minims] of magnesia magma, diluting it with sufficient water to make the required volume.

Always keep the diluted solution of ferric sulphate and the magnesia mixture on hand in separate bottles, ready for immediate use, so that the antidote may be quickly prepared.

Uses.—This preparation furnishes a ready and efficient antidote against arsenic poisoning. Ferric hydroxide is produced when the mixture of magnesium oxide is added to the diluted solution of ferric tersulphate, and, as the magnesium oxide is in excess and acidity thus prevented, no harm can result from not separating the by-products of the reaction. It contains, in addition, magnesium sulphate and hydroxide. It has been shown that no soluble compound with arsenic is formed when it is used as an antidote, and the presence of the magnesium salts, from a therapeutical point of view, is not objectionable. The alternative use of milk of magnesia to replace the magnesium oxide mixture, as suggested by the Pharmacopœial note, is due to the difficulty experienced in keeping the magnesia-water mixture over an extended period without its solidifying. The magnesia magma exhibits no such tendency to become solid.

Average Dose.—4 fluidounces (120 mils).

SYRUPUS FERRI IODIDI. U. S. Syrup of Ferrous Iodide

Not less than 4.75 per cent. nor more than 5.25 per cent. of FeI_2 (309.68). Keep it in completely filled, tightly-stoppered bottles.

This syrup is prepared by forming a solution of ferrous iodide by acting on iron wire with iodine in the presence of water; the details of the process will be found on page 328. The green solution of ferrous iodide, thus prepared, is then protected by its addition to sugar, and the syrup is poured into small, well-stoppered bottles which are to be completely filled. A small amount of diluted hypophosphorous acid is added to aid in its preservation. The syrup is often stored so that it will be exposed to bright daylight, to prevent the separation of free iodine, to which the irritant action is due, the syrup being prone to decomposition and discoloration from its separation; when iodine is diffused through water and is exposed to light, colorless hydriodic acid is formed, and this is measurably protected from change through the intervention of the syrup.

Official Description.—A transparent, pale yellowish-green, syrupy liquid.

Taste and Reaction.—Having a sweet, strongly ferruginous taste and a slightly acid reaction.

Specific Gravity.—About 1.35 at 25° C. (77° F.).

Tests for Identity.—Add a few drops of potassium ferricyanide to 5 mils of Syrup of Ferrous Iodide; a blue precipitate is produced.

Impurities and Tests for Impurities.—*Free Iodine.*—Mix 5 mils of Syrup of Ferrous Iodide with a few drops of starch T.S. and add three drops of chlorine water; the liquid acquires a deep blue color. No blue color is produced in the Syrup by starch T.S. alone.

Assay.—Dilute about 10 Gm. of Syrup of Ferrous Iodide, accurately weighed, with 30 mils of distilled water, add 50 mils of tenth-normal silver nitrate V.S., and 5 mils of nitric acid and heat on a water bath until the precipitate of silver iodide is yellow. Cool, add 2 mils of ferric ammonium sulphate T.S., and determine the residual silver nitrate by titration with tenth-normal potassium sulphocyanate V.S. It shows not less than 4.75 per cent. nor more than 5.25 per cent. of FeI_2. Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.015484 Gm. of FeI_2. Each gramme of Syrup of Ferrous Iodide corresponds to not less than 3.07 mils nor more than 3.4 mils of tenth-normal silver nitrate V.S.

Uses.—It is used as an alterative, the dose being from ten to thirty minims (0.6 to 2 mils); it should be largely diluted, and drawn through a glass tube to protect the teeth from injury.

FERRI PHOSPHAS. U. S. Ferric Phosphate

[**Ferr. Phos.**—Ferri Phosphas Solubilis, U. S. P. VIII Soluble Ferric Phosphate]

Ferric Phosphate rendered soluble by the presence of sodium citrate. It contains not less than 12 per cent. of Fe. Preserve it in amber-colored, well-stoppered bottles, protected from light.

Preparation.—No process is given in the U. S. P. IX for this scaled salt; the process of the U. S. P. 1890 is appended.

	Metric	Old form
Ferric Citrate	**50 Gm.**	10 oz. av.
Sodium Phosphate, uneffloresced	**55 Gm.**	11 oz. av.
Distilled Water	**100 mils**	19 fl. oz.

Dissolve the ferric citrate in the distilled water by heating on a water bath. To this solution add the sodium phosphate, and stir constantly until it is dissolved. Evaporate the solution, on a water bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of thick syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales.

This scaled salt is very different from the insoluble, slate-colored powder of iron phosphate formerly official. It is not a definite chemical compound, but is sometimes termed sodio-ferric citro-phosphate. It greatly resembles the official ferric pyrophosphate.

Official Description.—It occurs as thin, bright green, transparent scales. The salt is permanent in dry air when excluded from light, but when unprotected, soon becomes discolored.

Odor, Taste, and Reaction.—Without odor, and having an acidulous, slightly saline taste. An aqueous solution of Ferric Phosphate (1 in 10) is slightly acid to litmus.

Solubility.—Ferric Phosphate is freely and completely soluble in water; insoluble in alcohol.

Tests for Identity.—The addition of ammonia water to an aqueous solution of Ferric Phosphate gives a reddish-brown color, but does not produce a precipitate.

Ferric Phosphate, when boiled with potassium hydroxide T.S., produces a brownish-red precipitate without evolving ammonia.

Boil an aqueous solution of Ferric Phosphate (1 in 10) with an excess of potassium hydroxide T.S. until deprived of its iron, strongly acidulate the filtrate with hydrochloric acid and cool a portion of the liquid. When mixed with an equal volume of magnesia mixture T.S., followed by a slight excess of ammonia water, this liquid affords an abundant, white, crystalline precipitate. This precipitate turns yellow when washed and treated with a few drops of silver nitrate T.S. (distinction from *pyrophosphate*).

Assay.—Dissolve about 1 Gm. of Ferric Phosphate, accurately weighed, in 25 mils of distilled water and 15 mils of hydrochloric acid in a glass-stoppered bottle, then add 3 Gm. of potassium iodide, securely stopper the bottle, keep it at a temperature of 40° C. (104° F.) for thirty minutes, then cool and titrate with tenth-normal sodium thiosulphate V.S., using starch T.S. as indicator. It shows not less than 12 per cent. of Fe. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.005584 Gm. of Fe. Each gramme of Ferric Phosphate corresponds to not less than 21.5 mils of tenth-normal sodium thiosulphate V.S.

N. F. Preparations.—Elixir Cinchonæ Alkaloidorum et Ferri; Elixir Ferri Phosphatis; Elixir Gentianæ et Ferri Phosphatis; Liquor Phosphatum Compositum; Syrupus Ferri, Quininæ et Strychninæ Phosphatum.

Uses.—This is a mild and safe ferruginous tonic. It is given in doses of four to ten grains (0.25 to 0.65 Gm.).

FERRI SULPHAS. U. S. Ferrous Sulphate

[**Ferr. Sulph.**—IRON PROTOSULPHATE]

It contains not less than 54.36 nor more than 57.07 per cent. of anhydrous ferrous sulphate, corresponding to about 99.5 per cent. of the crystallized salt [$FeSO_4+7H_2O=278.02$]. Preserve it in well-closed containers.

Preparation.—This salt is rarely made by the pharmacist, because the commercial article is sold at a very low price. The following is a formerly official British process:

Take of iron wire, 4 oz. av.; sulphuric acid, 4 fl. oz. [Imperial measure]; distilled water, 1½ pints [Imp. meas.]. Pour the water on the iron placed in a porcelain dish, add the sulphuric acid, and, when the evolution of gas has nearly ceased, boil for ten minutes. Filter now through paper, and, after the lapse of twenty-four hours, separate the crystals which have been deposited from the solution. Let these be dried on filter paper placed on porous bricks, and be preserved in a stoppered bottle.

The salt is a by-product in the manufacture of hydrogen, the following being the reaction:

$$\underset{\text{Iron}}{Fe_2} + \underset{\text{Sulphuric Acid}}{2H_2SO_4} = \underset{\text{Ferrous Sulphate}}{2FeSO_4} + \underset{\text{Hydrogen}}{4H}$$

Official Description.—It occurs as pale bluish-green, monoclinic prisms; efflorescent in dry air. On exposure to moist air, the crystals rapidly oxidize, and become coated with brownish-yellow, basic ferric sulphate. When it has thus deteriorated, the salt must not be used for any official purpose.

Odor, Taste, and Reaction.—Without odor, and having a saline, styptic taste. An aqueous solution of the salt (1 in 20) is acid to litmus.

Solubility.—One Gm. of Ferrous Sulphate dissolves in 1.4 mils of water at 25° C. (77° F.); in 0.4 mil of boiling water; insoluble in alcohol.

Tests for Identity.—When slowly heated to 115° C. (239° F.), the crystals disintegrate, and the salt loses the greater part of its water of crystallization.

An aqueous solution of the salt, even when highly diluted, gives with potassium ferricyanide T.S. a blue color or precipitate, and with barium chloride T.S. a white precipitate insoluble in hydrochloric acid.

Impurities and Tests for Impurities.—*Heavy Metals.*—Dissolve 1 Gm. of the salt in about 50 mils of distilled water containing 1 mil of diluted sulphuric acid, heat the solution to boiling, oxidize it with nitric acid and then mix it with a slight excess of ammonia water and filter. The filtrate is colorless, and, after acidulating with hydrochloric acid, it does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Free Acid.—Agitate 1 Gm. of Ferrous Sulphate in small fragments during four or five minutes, with 10 mils of alcohol, and filter the mixture; the filtrate does not immediately redden moistened blue litmus paper.

Assay.—Dissolve about 1 Gm. of Ferrous Sulphate, accurately weighed, in about 25 mils of diluted sulphuric acid and titrate with tenth-normal potassium permanganate V.S. until a permanent pink color is produced. It shows not less than 54.36 per cent. nor more than 57.07 per cent. of $FeSO_4$. Each mil of tenth-normal potassium permanganate V.S. used corresponds to 0.015191 Gm. of $FeSO_4$. Each gramme of Ferrous Sulphate corresponds to not less than 35.78 mils nor more than 37.57 mils of tenth-normal potassium permanganate V.S.

U. S. P. Preparations.—Ferri Carbonas Saccharatus; Ferri Sulphas Exsiccatus; Ferri Sulphas Granulatus; Liquor Ferri Subsulphatis; Liquor Ferri Tersulphatis; Massa Ferri Carbonatis.

N. F. Preparations.—Liquor Ferri Oxysulphatis; Liquor Zinci et Ferri Compositus; Mistura Ferri Composita.

Uses.—This is a very astringent iron salt. When used internally, the exsiccated or granulated salt is preferred. The impure ferrous sulphate, called *copperas*,[1] is used as a disinfectant. The dose of the sulphate is one to three grains (0.065 to 0.2 Gm.).

FERRI SULPHAS EXSICCATUS. U.S. Exsiccated Ferrous Sulphate

[Ferr. Sulph. Exsic.—DRIED FERROUS SULPHATE]

Exsiccated Ferrous Sulphate contains the equivalent of not less than 80 per cent. of the anhydrous salt [$FeSO_4 = 151.91$].

	Metric	Old form
***Ferrous Sulphate,** in coarse powder.............	100 Gm.	25 oz. av.

Allow the salt to effloresce at a temperature of about 40° C. (104° F.), in dry air, and then heat it in a porcelain dish, on a water bath, constantly stirring, until the product weighs from 64 to 65 Gm. [old form 16 oz. av.]. Lastly, reduce the residue to a fine powder, and transfer it at once to dry, well-stoppered bottles.

This process does not deprive the ferrous sulphate of all of its water of crystallization, about 15 per cent. being retained. One hundred parts of crystallized sulphate yield about 64 per cent. of the exsiccated salt.

Official Description.—Exsiccated Ferrous Sulphate is a grayish-white powder, slowly soluble in water.

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[1] This unfortunate synonym, "*copperas*," has led to a great many errors, through the impression that this salt must contain copper. It is often confounded with the poisonous salt copper sulphate, or blue vitriol, and they have been substituted for each other.

Tests for Identity and Impurities.—A solution of the salt (1 in 20) in distilled water which has been recently boiled and cooled is not more than slightly turbid, and conforms to the reactions and tests under *Ferri Sulphas*, except the test for free acid, when taken in proportionate amount.

Assay.—Dissolve about 0.8 Gm. of Exsiccated Ferrous Sulphate, accurately weighed in a stoppered weighing-bottle, in about 25 mils of diluted sulphuric acid and titrate with tenth-normal potassium permanganate V.S. until a permanent pink color is produced. It shows not less than 80 per cent. of $FeSO_4$. Each mil of tenth-normal potassium permanganate V.S. used corresponds to 0.015191 Gm. of $FeSO_4$. Each gramme of Exsiccated Ferrous Sulphate corresponds to not less than 52.7 mils of tenth-normal potassium permanganate V.S.

N. F. Preparations.—Pilulæ Aloes et Ferri; Pilulæ Ferri, Quininæ, Aloes et Nucis Vomicæ.

Uses.—Exsiccated ferrous sulphate is a grayish-white powder, and is principally used in making pills, the crystallized sulphate being unfitted for the purpose on account of the large proportion of water that it contains. Five grains of the crystals are represented by three grains of the exsiccated sulphate. The dose is one grain (0.065 Gm.).

FERRI SULPHAS GRANULATUS. U. S. Granulated Ferrous Sulphate

[**Ferr. Sulph. Gran.**—PRECIPITATED FERROUS SULPHATE]

	Metric	Old form
***Ferrous Sulphate**, in coarse powder	**100 Gm.**	4 oz. av
Distilled Water	**100 mils**	4 fl. oz.
Diluted Sulphuric Acid	**5 mils**	1½ fl. dr.
Alcohol	**25 mils**	1 fl. oz.

Dissolve the ferrous sulphate in the distilled water previously heated to boiling, add the diluted sulphuric acid, and filter the solution while hot. Evaporate the solution immediately in a tared porcelain dish, on a sand bath, until it weighs 150 Gm. [old form 6 oz. av.], and then cool it quickly with constant stirring. Transfer the product to a glass funnel stopped with a plug of purified cotton, and, when it has thoroughly drained, pour the alcohol upon it. When this has also drained, spread the crystalline powder on bibulous paper, dry it quickly at room temperature, and transfer it at once to dry, well-stoppered bottles.

Official Description.—Granulated Ferrous Sulphate is a very pale bluish-green, crystalline powder, which should conform in every respect to the reactions and tests given under *Ferri Sulphas*.

U. S. P. Preparation.—Pilulæ Ferri Carbonatis.

Ferrous sulphate is insoluble in alcohol; hence, if a strong aqueous solution is poured into alcohol, it is precipitated in the form of a granular crystalline powder, and this method was used in the U. S. P. 1880 for preparing this salt. The process of subsequent Pharmacopœias differed in that the sulphate is not precipitated but granulated, and subsequently washed with alcohol to free it from impurities and to facilitate the drying of the granules.

Uses.—Granulated ferrous sulphate should be used in preference to the large crystals at the prescription counter, the soluble impurities being washed out by the alcohol. It is much less liable to oxidation and change than the ordinary crystallized sulphate. The dose is about one and one-half grains (0.1 Gm.).

LIQUOR FERRI ET AMMONII ACETATIS. U. S. Solution of Iron and Ammonium Acetate

[**Liq. Ferr. et Ammon. Acet.**—BASHAM'S MIXTURE]

	Metric	Old form
***Tincture of Ferric Chloride**	**40 mils**	**4 fl. dr.**
Diluted Acetic Acid	**60 mils**	**6 fl. dr.**
Solution of Ammonium Acetate	**500 mils**	**6¼ fl. oz.**
Aromatic Elixir	**120 mils**	**1½ fl. oz.**
Glycerin	**120 mils**	**1½ fl. oz.**
Distilled Water, a sufficient quantity,		
To make	**1000 mils**	12½ fl. oz.

To the solution of ammonium acetate (which must be slightly acid) add, successively, the diluted acetic acid, the tincture of ferric chloride, the aromatic elixir, and the glycerin, and lastly, enough distilled water to make the product measure 1000 mils [old form 12½ fl. oz.]. This preparation must not be dispensed unless it has been recently prepared.

Official Description.—It is a clear, reddish-brown liquid.

Odor, Taste and Reaction.—It has a sweetish, saline and afterward slightly astringent taste and possesses an aromatic odor. The Solution is acid to litmus.

Specific Gravity.—About 1.039 at 25° C. (77° F.).

Tests for Identity.—The Solution yields a blue precipitate with potassium ferrocyanide T.S., but the addition of ammonia water produces no precipitate.

When Solution of Iron and Ammonium Acetate is heated with potassium hydroxide T.S., ammonia is evolved.

Add 1 mil each of sulphuric acid and alcohol to 5 mils of the Solution and boil the mixture; ethyl acetate is formed, recognizable by its odor.

This solution is not intended to be permanent, and in time will decompose, besides the freshly prepared solution, containing dissolved carbonic acid, is more agreeable to the taste than one which is "flat."

Uses.—This is a mild ferruginous solution, of very pleasant taste, and is often known as Basham's mixture. It is given in doses of two fluidrachms to one-half fluidounce (8 to 15 mils).

LIQUOR FERRI SUBSULPHATIS. U. S. Solution of Ferric Subsulphate

[**Liq. Ferr. Subsulph.**—MONSEL'S SOLUTION SOLUTION OF BASIC FERRIC SULPHATE]

An aqueous solution containing basic ferric sulphate corresponding to not less than 13 per cent. nor more than 14 per cent. of Fe.

	Metric	Old form
***Ferrous Sulphate**	**675 Gm.**	16 oz. av. 628 gr.
Sulphuric Acid	**65 Gm.**	7 fl. dr.
Nitric Acid,		
Distilled Water, each, a sufficient quantity,		
To make	**1000 Gm.**	1 pint

Add the sulphuric acid to 500 mils [or measure, old form 7 fl. oz.] of distilled water in a tared, capacious porcelain dish, heat the mixture to nearly 100° C. (212° F.), then add 70 Gm. [old form 1 fl. oz. 100 min.] of nitric acid and mix well. Divide the ferrous sulphate, coarsely powdered, into four approximately equal portions, and add these portions one at a time to the hot liquid, stirring after each addition until effervescence ceases. If, after the ferrous sulphate has dissolved, the solution is of a black color, add nitric acid, a few drops at a time, with heating and stirring, until red fumes cease to be evolved. Boil the Solution until it assumes a red color and is free from nitric acid, as indicated by the test given below. During the heating add distilled water from time to time to maintain about the original volume. Lastly, add enough distilled water to make the product weigh 1000 Gm. [or measure, old form 1 pint]. Filter if necessary. Keep it in well-stoppered containers, in a moderately warm place [not under 22° C. (71.6° F.)], protected from light.

This Solution sometimes crystallizes, forming a semi-solid, whitish mass. When this occurs, the application of a gentle heat will restore the liquid condition.

Note.—Solution of Ferric Subsulphate is to be dispensed when *Solution of Persulphate of Iron* has been prescribed by the physician.

When ferrous sulphate is added to a hot mixture of nitric and sulphuric acids, a copious evolution of reddish-yellow vapors of N_2O_4 takes place, and the iron assumes a black tint, due to the formation of a compound of the ferrous sulphate with the nitric oxide. This black color disappears under the influence of heat or the addition of more nitric acid, and, when effervescence ceases, the dark reddish-brown liquid is left, which is widely known as *Monsel's Solution.* The reaction is similar to that given under solution of ferric chloride (page 868).

Official Description.—A dark reddish-brown liquid; miscible with water and alcohol without decomposition.

Odor, Taste, and Reaction.—Odorless or nearly so, of an acid, strongly styptic taste, and acid reaction.

Specific Gravity.—About 1.548 at 25° C. (77° F.).

Tests for Identity.—Separate portions of an aqueous dilution of the Solution (1 in 20) yield a brownish-red precipitate with ammonia water, a blue precipitate with potassium ferrocyanide T.S., and a white precipitate, insoluble in hydrochloric acid, with barium chloride T.S.

Impurities and Tests for Impurities.—*Nitric Acid.*—Add a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of sulphuric acid and an aqueous dilution of the Solution (1 in 10); the crystal does not become brown nor does a brownish-black color develop around it.

Ferrous Salt.—Add a few drops of freshly prepared potassium ferricyanide T.S. to 2 mils of an aqueous dilution of the Solution (1 in 20); a brown color is produced without a tinge of green or greenish-blue.

Assay.—Transfer about 1.5 Gm. of Solution of Ferric Subsulphate to a tared flask, stopper and weigh accurately, then add 5 mils of hydrochloric acid, 25 mils of distilled water, and 2 Gm. of potassium iodide, securely stopper the flask and allow the mixture to stand for thirty minutes at a temperature of 40° C. (104° F.). Cool the liquid, dilute it with 50 mils of distilled water, and then titrate with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator. It shows not less than 13 per cent. nor more than 14 per cent. of Fe. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.005584 Gm. of Fe. Each gramme of Solution of Ferric Subsulphate corresponds to not less than 23.3 mils nor more than 25.1 mils of tenth-normal sodium thiosulphate V.S.

Uses.—This preparation is probably the most valuable official styptic solution. It is less irritating than the solution of ferric sulphate, owing to the smaller proportion of sulphuric acid. It is used externally in stopping hemorrhages, and internally in doses of three to six minims (0.2 to 0.4 mils), largely diluted with water.

LIQUOR FERRI TERSULPHATIS. U. S. Solution of Ferric Sulphate

[Liq. Ferr. Tersulph.—SOLUTION OF IRON TERSULPHATE]

An aqueous solution containing normal ferric sulphate [$Fe_2(SO_4)_3$ = 399.89], corresponding to not less than 9.5 per cent. nor more than 10.5 per cent. of Fe.

	Metric	Old form
***Ferrous Sulphate**	**500 Gm.**	11 oz. av. 418 gr.
Sulphuric Acid	**96 Gm.**	1 fl. oz. 103 min.
Nitric Acid,		
Distilled Water, each, a sufficient quantity,		
To make	**1000 Gm.**	1 pint

Add the sulphuric acid to about 250 mils [old form 3¾ fl. oz.] of distilled water in a tared, capacious porcelain dish, heat the mixture to nearly 100° C. (212° F.), then add 56 Gm. [or measure, old form 7 fl. dr.] of nitric acid, and mix well. Divide the ferrous sulphate, coarsely powdered, into four approximately equal portions, and add these portions one at a time to the hot liquid, stirring after each addition until effervescence ceases. When all of the ferrous sulphate is dissolved, if the Solution has acquired a black color, add nitric acid, a few drops at a time, heating and stirring until red fumes cease to be evolved, and the Solution assumes a clear reddish-brown color; then boil the liquid until it is free from nitric acid, as indicated by the test given below. During the heating add distilled water from time to time to maintain about the original volume. Lastly, add enough distilled water to make the product weigh 1000 Gm. [or measure, old form 1 pint]. Filter if necessary.

This solution differs from the solution of ferric subsulphate merely in containing a larger proportion of sulphuric acid. It has the sp. gr. 1.432, and is a solution of the *true* persulphate, $Fe_2(SO_4)_3$, or normal ferric sulphate. The reaction for solution of ferric sulphate is as follows:

$$\underset{\text{Ferrous Sulphate}}{6FeSO_4} + \underset{\text{Sulphuric Acid}}{3H_2SO_4} + \underset{\text{Nitric Acid}}{2HNO_3} = \underset{\text{Ferric Sulphate}}{3Fe_2(SO_4)_3} + \underset{\text{Nitrogen Dioxide}}{2NO} + \underset{\text{Water}}{4H_2O}$$

Official Description.—A yellowish-brown liquid; it is miscible with water and alcohol.

Odor, Taste, and Reaction.—Almost odorless, having an acid, strongly styptic taste, and an acid reaction.

Specific Gravity.—About 1.432 at 25° C. (77° F.).

Tests for Identity.—Separate portions of an aqueous dilution of the Solution (1 in 20) yield a brownish-red precipitate with ammonia water, a blue precipitate with potassium ferrocyanide T.S., and a white precipitate, insoluble in hydrochloric acid, with barium chloride T.S.

Impurities and Tests for Impurities.—*Nitric Acid.*—Add a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of sulphuric acid and an aqueous dilution of the Solution (1 in 10); the crystal does not become brown, nor does a brownish-black color develop around it.

Ferrous Salt.—Add a few drops of freshly prepared potassium ferricyanide T.S. to 2 mils of an aqueous dilution of the Solution (1 in 20); a brown color is produced without a tinge of green or greenish-blue.

Assay.—Transfer about 1.5 Gm. of Solution of Ferric Sulphate to a tared flask, stopper and weigh accurately, then add 5 mils of hydrochloric acid, 25 mils of distilled water, and 2 Gm. of potassium iodide, securely stopper the flask and allow the mixture to stand for thirty minutes at a temperature of 40° C. (104° F.). Cool the liquid, dilute it with 50 mils of distilled water and then titrate with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator. It shows not less than 9.5 per cent. nor more than 10.5 per cent. of Fe. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.005584 Gm. of Fe. Each gramme of Solution of Ferric Sulphate corresponds to not less than 17 mils nor more than 18.8 mils of tenth-normal sodium thiosulphate V.S.

Uses.—This solution is largely used in pharmacy for preparing ferric hydroxide by precipitation with ammonia water (see below). From this many of the iron salts and solutions are made. It is not used medicinally to any extent, the solution of the subsulphate being preferred.

MAGMA FERRI HYDROXIDI. N. F. Ferric Hydroxide Magma

[**Magm. Ferr. Hydrox.**—FERRI HYDROXIDUM, U. S. P. VIII
FERRIC HYDROXIDE]

	Metric	Old form
Solution of Ferric Sulphate	**100 mils**	10 fl. oz.
Ammonia Water	**138 mils**	13¾ fl. oz.
Water, a sufficient quantity,		
To make	**300 Gm.**	30 oz. av.

Add the solution of ferric sulphate, previously diluted with 1000 mils [old form 6 pints] of cold water, to the ammonia water, previously diluted with 500 mils [old form 3 pints] of cold water, stirring constantly. As soon as the precipitate has subsided, draw off the clear liquid by means of a siphon, then mix the precipitate intimately with about 1000 mils [old form 6 pints] of cold water, again draw off the clear liquid after subsidence of the precipitate, and repeat this operation, until a portion of the decanted liquid gives not more than a slight cloudiness with barium chloride T.S. Finally, transfer the precipitate to a wet strainer, and, after it has drained, mix it with sufficient cold water to make the mixture weigh 300 Gm. [old form 30 oz. av.].

Official Description.—Ferric Hydroxide ($Fe(OH)_3=106.86$), thus prepared, is a brownish-red magma, wholly soluble in hydrochloric acid without effervescence.

When Ferric Hydroxide is to be made in haste, for use as an antidote, the washing may be performed more quickly, though less perfectly, by transferring the precipitate at once to a wet muslin strainer, pressing forcibly with the hands, until no more liquid passes, and then adding enough water to make the whole weigh about 300 Gm. [old form 30 oz. av.].

The reaction is as follows:

$$\underset{\substack{\text{Ferric}\\\text{Sulphate}}}{Fe_2(SO_4)_3} + \underset{\substack{\text{Ammonium}\\\text{Hydroxide}}}{6NH_4OH} = \underset{\substack{\text{Ferric}\\\text{Hydroxide}}}{2Fe(OH)_3} + \underset{\substack{\text{Ammonium}\\\text{Sulphate}}}{3(NH_4)_2SO_4}$$

Ammonia water is preferred as the precipitant, because an excess is easily detected by the odor, and the salt formed is readily washed out.

Uses.—This compound is used as the basis in preparing several iron salts, citrate, tartrate, etc., and also as an antidote to poisoning by arsenic. For the latter purpose it should be administered freely. It acts by producing insoluble ferrous arsenate as follows:

$$\underset{\substack{\text{Ferric}\\\text{Hydroxide}}}{4Fe(OH)_3} + \underset{\substack{\text{Arsenic}\\\text{Trioxide}}}{As_2O_3} = \underset{\substack{\text{Ferrous}\\\text{Arsenate}}}{Fe_3(AsO_4)_2} + \underset{\substack{\text{Ferrous}\\\text{Hydroxide}}}{Fe(OH)_2} + \underset{\text{Water}}{5H_2O}$$

It should never be kept on hand, as it decomposes even when kept under water; the ingredients should always be kept already weighed out, placed in suitable bottles, *and in an accessible and well-known place in the store,* so that if wanted quickly for an antidote it can be made without the unnecessary loss of a moment's time. The official antidote for arsenic, Ferri Hydroxidum cum Magnesii Oxido, is preferred, however, as it may be administered without the loss of time necessitated by washing this magma.

LIQUOR FERRI ACETATIS. N. F. Solution of Ferric Acetate [Liq. Ferr. Acet.]

An aqueous solution containing about 31 per cent. of anhydrous ferric acetate [$Fe(C_2H_3O_2)_3 = 232.91$], corresponding to about 7.5 per cent. metallic iron (Fe).

	Metric	Old form
Solution of Ferric Sulphate	**800 Gm.**	30 oz. av. 428 gr.
Glacial Asetic Acid	**260 Gm.**	10 oz. av. 35 gr.
Ammonia Water	**850 mils**	31 fl. oz. 265 min.
Water, **Distilled Water,** each, a sufficient quantity,		
To make	**1000 Gm.**	2 pints

Mix the ammonia water with 3000 mils [old form about 6 pints] of cold water, and the solution of ferric sulphate with 10,000 mils [old form about 20 pints] of cold water. Add the latter solution slowly to the diluted ammonia water, stirring constantly. Allow the mixture to stand until the precipitate has subsided as far as practicable, and then decant the supernatant liquid. Add to the precipitate 6000 mils [old form about 12 pints] of boiling water, mix well, and again set the mixture aside, and decant as before. Repeat the washing with successive portions of boiling water, in the same manner, until the washings are no longer affected by barium chloride T.S. Transfer the mixture to a wet muslin strainer, allow the precipitate to drain completely, and press it, folded in the strainer, until its weight is reduced to 700 Gm. [old form about 27 oz. av.] or less. Now add the precipitate gradually to the glacial acetic acid, contained in a tared jar provided with a glass stopper, stirring the mixture after each addition until the magma added is nearly dissolved before adding another portion. Finally, add enough distilled water to make the product weigh 1000 Gm. [or measure, old form 2 pints], allow it to become clear by subsidence, and decant the clear solution. Keep the product in well-stoppered bottles, in a cool place, protected from light.

Assay.—Add about 2 Gm. of the Solution, accurately weighed, to 2 mils of hydrochloric acid and 10 mils of solution of hydrogen dioxide, and evaporate it to dryness. Dissolve the residue in 2 mils of hydrochloric acid and 40 mils of distilled water, transfer to a flask, add 2 Gm. of potassium iodide, stopper the flask and warm the mixture to 40° C. (104° F.) for thirty minutes. Then cool and titrate the liberated iodine with tenth-normal sodium thiosulphate V.S. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.005584 Gm. of metallic iron (Fe).

Uses.—It is used as an astringent, diuretic and iron tonic in doses of five minims (0.3 mil).

LIQUOR FERRI ALBUMINATI. N. F. Solution of Albuminate of Iron [Liq. Ferr. Albumin.]

	Metric	Old form
Fresh Egg Albumen	60.0 Gm.	2 oz. av.
Solution of Ferric Oxychloride	130.0 Gm.	4 oz. av. 149 gr.
Sodium Citrate	12.5 Gm.	182 gr.
Aromatic Elixir	400.0 mils	12 fl. oz. 384 min.
Alcohol	120.0 mils	3 fl. oz. 403 min.
Distilled Water, a sufficient quantity,		
To make	1000 mils	2 pints

Mix the fresh egg albumen with 180 mils [old form 5 fl. oz. 365 min.] of cold distilled water, add the solution of ferric oxychloride (which should be freshly prepared), stirring constantly, and allow the mixture to stand for two hours. Then add the sodium citrate, previously dissolved in 100 mils [old form 3 fl. oz. 96 min.] of distilled water, and, when solution has been effected, add the previously mixed aromatic elixir and alcohol and finally enough distilled water to make the product measure 1000 mils [old form 2 pints]. Allow the preparation to stand during twenty-four hours and filter.

Uses.—It is used as an iron tonic in a dose of from one to two fluidrachms (4 to 8 mils).

LIQUOR FERRI CITRATIS. N. F. Solution of Ferric Citrate [Liq. Ferr. Cit.]

An aqueous solution containing ferric citrate corresponding to not less than 7.25 per cent. of metallic iron (Fe).

	Metric	Old form
Solution of Ferric Sulphate	840 Gm.	34 oz. av. 460 gr.
Citric Acid	300 Gm.	12 oz. av. 227 gr.
Ammonia Water	880 mils	35 fl. oz. 96 min.
Water, a sufficient quantity,		
To make	1000 Gm.	2 pints

Mix the ammonia water with 3000 mils [old form 6 pints] of cold water, and the solution of ferric sulphate with 10,000 mils [old form 20 pints] of cold water. Add the latter solution slowly to the diluted ammonia water, stirring constantly. Pour the mixture upon a wet muslin strainer, and allow the liquid to run off and the precipitate to drain. Then remove the moist mass from the strainer, mix it well with 6000 mils [old form 12 pints] of cold water, again pour it on the strainer, and let it drain. Repeat this washing with several successive portions of cold water, in the same manner, until the washings cease to produce more than a faint cloudiness with barium chloride T.S. Then allow the precipitate to drain completely, transfer it to a porcelain dish, add the citric acid, and heat the mixture, on a water bath, to 60° C. (140° F.), stirring constantly until the magma is dissolved. Lastly, filter the liquid, and evaporate it, at the above-mentioned temperature, until it weighs 1000 Gm. [or measure, old form 2 pints]

Assay.—Add about 2 Gm. of the Solution, accurately weighed, to 2 mils of hydrochloric acid and 10 mils of solution of hydrogen dioxide, and evaporate to dryness. Dissolve the residue in 2 mils of hydrochloric acid and 40 mils of distilled water, transfer to a flask, add 2 Gm. of potassium iodide, stopper the flask and warm the mixture to 40° C. (104° F.) for thirty minutes. Then cool and titrate the liberated iodine with tenth-normal sodium thiosulphate V.S. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.005584 Gm. of metallic iron (Fe). Each gramme of Solution of Ferric Citrate corresponds to not less than 12.2 mils of tenth-normal sodium thiosulphate V.S.

Uses.—It is used as an iron tonic in doses of ten minims (0.6 mil).

FERRI GLYCEROPHOSPHAS. N. F. Ferric Glycerophosphate

[Ferr. Glycerophos.—FERRIC GLYCERINOPHOSPHATE]

It contains a variable quantity of $Fe_2(C_3H_7O_6P)_3$ (621.97) corresponding to not less than 14 per cent. nor more than 16 per cent. of Fe. Preserve it in well-closed containers, protected from light.

Preparation.—It may be prepared by adding solution of ferric sulphate to solution of barium glycerophosphate, filtering out the barium sulphate and evaporating the filtrate or by dissolving ferric hydroxide in glycerophosphoric acid and evaporating the solution.

Official Description.—It occurs as yellowish-green, transparent, amorphous scales or as a greenish-yellow powder.

Odor, Taste, and Reaction.—Odorless and nearly tasteless. An aqueous solution is acid to litmus and becomes turbid when heated.

Solubility.—One gramme dissolves slowly in about 2 mils of water at 25° C. (77° F.); insoluble in alcohol.

Tests for Identity.—An aqueous solution of the salt (1 in 20) is colored dark blue by potassium ferrocyanide T.S.; on the subsequent addition of hydrochloric acid a dark blue precipitate is produced.

Heat a powdered mixture of about 0.1 Gm. of the salt with about 0.5 Gm. of potassium bisulphate; the pungent vapors of acrolein are evolved.

Incinerate 0.5 Gm. of the salt; it yields a red-brown residue, which is not alkaline to moistened litmus paper.

Impurities and Tests for Impurities.—*Phosphate.*—Not more than a slight yellow turbidity is produced at once on mixing 5 mils of an aqueous solution of the salt (1 in 50) with 10 mils of ammonium molybdate T.S., but on standing or on warming, a yellow precipitate is formed.

Sulphate.—An aqueous solution of the salt (1 in 50), acidulated with hydrochloric acid, does not become more than slightly turbid on the addition of barium chloride T.S.

Chloride.—Another portion of this aqueous solution, acidulated with nitric acid, does not become more than slightly turbid on the addition of silver nitrate T.S.

Assay.—Dissolve about 0.5 Gm. of Ferric Glycerophosphate, accurately weighed, in 50 mils of distilled water, in a 100-mil glass-stoppered flask, add 5 mils of hydrochloric acid and about 3 Gm. of potassium iodide. Warm to 40° C. (104° F.), and allow the mixture to stand one-half hour at this temperature, in the stoppered flask, cool, and then titrate the liberated iodine with tenth-normal sodium thiosulphate V.S., using starch T.S. as indicator. It shows not less than 14 per cent. nor more than 16 per cent. of Fe. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.005584 Gm. of Fe. Each gramme of Ferric Glycerophosphate corresponds to not less than 25.07 mils nor more than 28.65 mils of tenth-normal sodium thiosulphate V.S.

N. F. Preparation.—Elixir Glycerophosphatum Compositum.

Uses.—It is used as a tonic and alterative, chiefly in the compound elixir. The dose is three grains (0.2 Gm.).

FERRI HYPOPHOSPHIS. N. F. Ferric Hypophosphite

(U. S. P. VIII)

[Ferr. Hypophos.]

It contains not less than 98 per cent. of $Fe(PH_2O_2)_3$ (251.01), corresponding to not less than 21.8 per cent. of Fe. Preserve it in well-closed containers.

Preparation.—This is among the hypophosphites brought into notice in consequence of their recommendation by Dr. Churchill in the treatment of phthisis, in which they were thought to be useful by the introduction of phosphorus into the system. This particular salt may be considered preferable to others when a marked condition of anæmia indicates a deficiency of iron in the tissues. It may be made by the action of hypophosphorous acid on ferrous carbonate formed by precipitation from ferrous sulphate; but, as some difficulty has been found in obtaining this acid perfectly pure, preference has been given to the plan of double decomposition. This salt may be made by causing ferrous sulphate and calcium hypophosphite to react on each other in molecular proportions represented by 480 grains of crystallized ferrous sulphate and 299 grains of calcium hypophosphite,—in the latter an allowance of 2 per cent. being made for impurities ordinarily found in that salt. These quantities will yield about 320 grains of ferric hypophosphite, and the reaction will be represented by the following formula:

$$\underset{\substack{\text{Calcium}\\\text{Hypophosphite}}}{Ca(PH_2O_2)_2} + \underset{\substack{\text{Ferrous}\\\text{Sulphate}}}{FeSO_4} = \underset{\substack{\text{Calcium}\\\text{Sulphate}}}{CaSO_4} + \underset{\substack{\text{Ferrous}\\\text{Hypophosphite}}}{Fe(H_2PO_2)_2}$$

Calcium sulphate is precipitated, and ferrous hypophosphite is held in solution. In this condition the salt is a ferrous compound, but on evaporation the ferrous salt becomes ferric, and acquires the properties detailed in the National Formulary.

Official Description.—It occurs as a white or grayish-white powder; permanent in the air.

Odor and Taste.—Odorless and nearly tasteless.

Solubility.—One gramme dissolves in 2300 mils of water at 25° C. (77° F.) and in 1200 mils of boiling water; more readily soluble in the presence of hypophosphorous acid or in a warm, concentrated solution of an alkali citrate, forming with the latter a green solution.

Tests for Identity.—When strongly heated in a dry test tube, the salt evolves spontaneously inflammable hydrogen phosphide gas, and finally leaves a residue of ferric pyrophosphate.

Ferric Hypophosphite is readily oxidized by nitric acid or other oxidizing agents.

Impurities and Tests for Impurities.—*Carbonate.*—Add 15 mils of acetic acid to 1 Gm. of the salt; no effervescence occurs. Heat this mixture to boiling and filter; the filtrate responds to the following tests:

Add to a portion of the filtrate a few drops of silver nitrate T.S. and warm; a brown to black coloration or precipitate is produced. To another portion of the filtrate add, drop by drop, an excess of mercuric chloride T.S.; a white precipitate of mercurous chloride is formed upon gently heating.

Calcium.—Another 5-mil portion of the filtrate shows no turbidity with ammonium oxalate T.S.

Sulphate.—Dissolve 1 Gm. of the salt in 20 mils of diluted hydrochloric acid, with the aid of heat, and add 1 mil of barium chloride T.S.; not more than a slight turbidity is produced.

Phosphate.—Boil 0.5 Gm. of the salt with 10 mils of sodium hydroxide T.S.; a reddish-brown precipitate is produced. Filter this mixture, slightly acidulate the filtrate with hydrochloric acid, add magnesia mixture T.S. and then an excess of ammonia water; no crystalline precipitate is produced.

Heavy Metals.—Dissolve 1 Gm. of the salt in about 25 mils of boiling distilled water by the aid of sufficient hydrochloric acid, added drop by drop, then add 2 mils of nitric acid, boil and add a slight excess of ammonia water; the filtrate is colorless, and, after acidulating with hydrochloric acid, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—To 1 Gm. of Ferric Hypophosphite, accurately weighed, add 10 mils of nitro-hydrochloric acid and evaporate to dryness on a water bath. Dissolve the residue in 25 mils of distilled water and 10 mils of hydrochloric acid, transfer the solution to a glass-stoppered flask, add 3 Gm. of potassium iodide, keep it at 40° C. (104° F.) for thirty minutes, cool and titrate the liberated iodine with tenth-normal sodium thiosulphate V.S., using starch T.S. as indicator. It shows not less than 21.8 per cent. of Fe. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.005584 Gm. of Fe, and 0.025101 Gm. of $Fe(PH_2O_2)_3$. Each gramme of Ferric Hypophosphite requires not less than 39.04 mils of tenth-normal sodium thiosulphate V.S.

N. F. Preparations.—Elixir Ferri Hypophosphitis; Elixir Hypophosphitum et Ferri; Liquor Ferri Hypophosphitis; Liquor Hypophosphitum Compositus; Syrupus Ferri Hypophosphitis; Syrupus Hypophosphitum Compositus.

Uses.—Ferric hypophosphite is given in anæmia and in cases of defective nerve nutrition; it is administered in the form of pills, powders, or syrup. The dose is from three to ten grains (0.2 to 0.65 Gm.).

LIQUOR FERRI HYPOPHOSPHITIS. N. F. Solution of Ferric Hypophosphite

[**Liq. Ferr. Hypophos.**—SOLUTION OF HYPOPHOSPHITE OF IRON]

	Metric	Old form
Ferric Hypophosphite	**165 Gm.**	5 oz. av. 222 gr.
Potassium Citrate	**215 Gm.**	7 oz. av. 77 gr.
Glycerin	**150 mils**	4 fl. oz. 384 min.
Water, a sufficient quantity,		
To make	**1000 mils**	2 pints

Triturate the ferric hypophosphite with 350 mils [old form about 11 fl. oz.] of water to a smooth mixture, then add the potassium citrate and glycerin, and apply a gentle heat, until solution has been effected. Allow the liquid to cool, add sufficient water to make the product measure 1000 mils [old form 2 pints] and filter.

Uses.—Used as nerve tonic and hematic in doses of fifteen minims (1 mil).

FERRI LACTAS. N. F. Ferrous Lactate

[**Ferr. Lact.**—IRON LACTATE]

It contains not less than 97 per cent. of $Fe(C_3H_5O_3)_2+3H_2O$ (287.98). Preserve it in well-closed containers.

Preparation.—It may be made by digesting iron filings with lactic acid until a neutral solution is produced, filtering and crystallizing.

Official Description.—It occurs as a greenish-white crystalline powder, or in crystalline masses.

Odor and Taste.—Having a slight, characteristic odor and a mild, sweet, and ferruginous taste.

Solubility.—One gramme dissolves slowly but almost completely in 40 mils of water at 25° C. (77° F.), and in 12 mils of boiling water; freely soluble in solutions of the alkali citrates, yielding a green-colored solution; almost insoluble in alcohol.

Tests for Identity.—When strongly heated, the salt froths, gives out dense, white, acrid fumes, then chars and finally leaves a brownish-red residue.

An aqueous solution of the salt is greenish-yellow, slightly acid to litmus, and separate portions give a deep blue precipitate with potassium ferricyanide T.S., and a light blue precipitate with potassium ferrocyanide T.S.

Impurities and Tests for Impurities.—*Sulphate.*—Separate portions of an aqueous solution of the salt (1 in 20), acidulated with nitric acid, do not give more than a slight opalescence with barium chloride T.S.

Chloride.—Or with silver nitrate T.S.

Sugar.—Mix 25 mils of an aqueous solution of the salt (1 in 50) with 5 mils of diluted sulphuric acid, boil the mixture for a few minutes, then precipitate the iron by an excess of potassium or sodium hydroxide T.S., and filter; the filtrate, mixed with a few drops of alkaline cupric tartrate V.S. and heated to boiling, does not give a red precipitate.

Butyric Acid.—A portion of the salt triturated with sulphuric acid does not develop an offensive odor.

Carbonate.—Nor is any gas evolved.

Readily Carbonizable Impurities.—This mixture, after standing for five minutes does not assume a brown color

Ignite 1 Gm. of the salt; the residue is not alkaline to moistened litmus paper, and does not contain anything soluble in water.

Assay.—Dissolve in a flask about 0.5 Gm. of Ferrous Lactate, accurately weighed, in 15 mils of solution of hydrogen dioxide and evaporate this solution on a water bath to 5 mils. Add 5 mils of sulphuric acid, boil the mixture for two minutes, cool to 40° C. (104° F.) and add 25 mils of distilled water and 0.5 Gm. of potassium iodide. Allow this mixture to stand for one-half hour at 40° C. (104° F.), cool, and then titrate the liberated iodine with tenth-normal sodium thiosulphate V.S., using starch T.S. as indicator. It shows not less than 97 per cent. of $Fe(C_3H_5O_3)_2+3H_2O$. Each mil of tenth-normal sodium thiosulphate V.S. corresponds to 0.0288 Gm. of $Fe(C_3H_5O_3)_2+3H_2O$. Each gramme of Ferrous Lactate requires not less than 33.7 mils of tenth-normal sodium thiosulphate V.S.

N. F. Preparations.—Elixir Ferri Lactatis; Syrupus Calcii Lactophosphatis et Ferri; Syrupus Ferri Lactophosphatis.

Uses.—Used much like other iron tonics; it is especially known for its absence of marked astringency. Given in doses of two to ten grains (0.13—0.65 Gm.).

LIQUOR FERRI NITRATIS. N. F. Solution of Ferric Nitrate
[Liq. Ferr. Nit.]

An aqueous solution containing ferric nitrate $[Fe(NO_3)_3=241.87]$ corresponding to not less than 1.3 per cent. of metallic iron (Fe).

	Metric	Old form
Solution of Ferric Sulphate	**145 Gm.**	**5 oz. av. 32 gr.**
Ammonia Water	**160 mils**	**5 fl. oz. 181 min.**
Nitric Acid	**71 Gm.**	**2 oz. av. 215 gr.**
Distilled Water,		
Water, each, a sufficient quantity,		
To make	**1000 Gm.**	**2 pints**

Mix the ammonia water with 500 mils [old form 1 pint] of cold water, and the solution of ferric sulphate with 1500 mils [old form 3 pints] of cold water. Add the latter solution to the diluted ammonia water, stirring constantly. Allow the mixture to stand until the precipitate has subsided as far as practicable, and then decant the supernatant liquid. Add to the precipitate 1000 mils [old form 2 pints] of cold water, mix well, and again set the mixture aside as before, then decant it. Repeat the treatment with successive portions of cold water, in the same manner, until the washings produce but a slight cloudiness with barium chloride T.S. Pour the washed ferric hydroxide on a wet muslin strainer, and let it drain thoroughly. Then transfer it to a porcelain dish, add the nitric acid, and stir with a glass rod until a clear solution is obtained. Finally, add sufficient distilled water to make the finished product weigh 1000 Gm. [or measure old form, 2 pints] and filter.

Assay.—Add about 2 Gm. of the solution, accurately weighed, to 2 mils of hydrochloric acid and 10 mils of solution of hydrogen dioxide and evaporate to dryness. Dissolve the residue in 2 mils of hydrochloric acid and 40 mils of distilled water, transfer to a flask, add 2 Gm. of potassium iodide and warm the mixture to 40° C. (104° F.) for thirty minutes. Cool the solution and titrate the liberated iodine with tenth-normal sodium thiosulphate V.S. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.005584 Gm. of metallic iron (Fe).

Uses.—It has been used as an astringent and chalybeate, but is rarely employed to-day. The dose is five minims (0.3 mil).

LIQUOR FERRI OXYCHLORIDI N. F. Solution of Ferric Oxychloride
[Liq. Ferr. Oxychlor.]

	Metric	Old form
Solution of Ferric Chloride	**300 mils**	**9 fl. oz. 288 min.**
Ammonia Water	**600 mils**	**19 fl. oz. 96 min.**
Glycerin	**125 mils**	**4 fl. oz.**
Hydrochloric Acid	**30 mils**	**461 min.**
Distilled Water, a sufficient quantity,		
To make	**1000 mils**	**2 pints**

Add the solution of ferric chloride, previously diluted with 1500 mils [old form 3 pints] of distilled water, to the ammonia water, previously diluted with 3000 mils [old form 6 pints] of distilled water, with constant stirring. Allow the mixture to stand until the precipitate has subsided, then decant the supernatant liquid and repeat the washing by decantation with distilled water three times. Now collect the precipitate on a strainer and wash it with distilled water until the washings give only a faint opalescence with silver nitrate T.S. Drain the precipitate, express and discard the excess of liquid, transfer it to an evaporating dish, add the hydrochloric acid, and stir the mixture occasionally during three days. If necessary, warm the mixture to 40° C. (104° F.) to effect solution. Allow it to cool, add the glycerin, and then sufficient distilled water to make the product measure 1000 mils [old form 2 pints]. Filter and transfer the product to small well-stoppered bottles and keep them in a cool place protected from sunlight.

Uses.—This solution is used in the preparation of other iron solutions, notably the albuminate and peptonates, and for this purpose it must be freshly made. It is more stable than Solution of *Dialyzed Iron*, which it resembles. The dose is ten to thirty minims (0.6–2 mils).

LIQUOR FERRI OXYSULPHATIS. N. F. Solution of Ferric Oxysulphate
[Liq. Ferr. Oxysulph.]

	Metric	Old form
Ferrous Sulphate	**165 Gm.**	5 oz. av. 222 gr.
Nitric Acid	**165 Gm.**	5 oz. av. 222 gr.
Distilled Water, a sufficient quantity,		
To make	**1000 mils**	2 pints

Dissolve the ferrous sulphate in 850 mils [old form about 27 fl. oz.] of boiling distilled water in a flask, gradually add the nitric acid, and heat until the escaping vapors cease to have a nitrous odor. When the reaction is complete, allow the liquid to cool and add sufficient distilled water to make the product measure 1000 mils [old form 2 pints].

LIQUOR FERRI PEPTONATI. N. F. Solution of Peptonate of Iron
[Liq. Ferr. Pepton.]

	Metric	Old form
Fresh Egg Albumen	**90.00 Gm.**	3 oz. av. 2 gr.
Pepsin	**1.00 Gm.**	15 gr.
Hydrochloric Acid	**4.00 mils**	61 min.
Sodium Citrate	**20.00 Gm.**	292 gr.
Solution of Ferric Oxychloride	**120.00 mils**	3 fl. oz. 403 min.
Alcohol	**150.00 mils**	4 fl. oz. 384 min.
Syrup	**50.00 mils**	1 fl. oz. 288 min.
Glycerin	**50.00 mils**	1 fl. oz. 288 min.
Oil of Orange	**0.15 mils**	2⅓ min.
Acetic Ether	**0.20 mil**	3 min.
Vanillin	**0.02 Gm.**	3/10 gr.
Sodium Hydroxide, **Distilled Water,** each, a sufficient quantity,		
To make	**1000 mils**	2 pints

Mix the albumen with 450 mils [old form 14 fl. oz. 192 min.] of distilled water and strain. Add the hydrochloric acid and pepsin previously dissolved in 25 mils [old form 384 minims] of distilled water and digest the mixture at a temperature between 40° and 50° C. (104°–122° F.) until no cloudiness is produced by adding two drops of nitric acid to about 4 mils [old form 61 minims] of the solution. Then filter the peptone solution and neutralize the filtrate with sodium hydroxide previously dissolved in about nine parts of distilled water. Now add the solution of ferric oxychloride and the sodium citrate and warm the mixture until the precipitate has dissolved. When cold add the vanillin, acetic ether, and oil of orange previously dissolved in the alcohol. Finally add the syrup, glycerin and sufficient distilled water to make the product measure 1000 mils [old form 2 pints].

It is important that the solution of ferric oxychloride be carefully and freshly prepared for this solution and often a boiling temperature is required for the solution of the precipitated iron peptonate. It should be clear and of a deep red color.

Uses.—This is an organic form of iron pleasantly flavored and given in a dose of one to two fluidrachms (4–8 mils).

LIQUOR FERRI PEPTONATI ET MANGANI. N. F. Solution of Peptonate of Iron and Manganese

[**Liq. Ferr. Pepton. et Mangan.**—Liquor Ferri Peptonati cum Mangano, N. F. III]

	Metric	Old form		
Fresh Egg Albumen	90.00 Gm.	3 oz. av.	2	gr.
Pepsin	1.00 Gm.		15	gr.
Hydrochloric Acid	4.00 mils		61	min.
Soluble Manganese Citrate	10.00 Gm.		146	gr.
Sodium Citrate	35.00 Gm.	1 oz. av.	74	gr.
Solution of Ferric Oxychloride	120.00 mils	3 fl. oz.	403	min.
Alcohol	150.00 mils	4 fl. oz.	384	min.
Syrup	50.00 mils	1 fl. oz.	288	min.
Glycerin	50.00 mils	1 fl. oz.	288	min.
Oil of Orange	0.15 mil		2⅓	min.
Acetic Ether	0.20 mil		3	min.
Vanillin	0.02 Gm.		8/10	gr.
Sodium Hydroxide, **Distilled Water**, each, a sufficient quantity,				
To make	**1000 mils**	**2 pints**		

Mix the albumen with 450 mils [old form 14 fl. oz. 192 min.] of distilled water and strain. Add the hydrochloric acid and pepsin, previously dissolved in 25 mils [old form 384 minims] of distilled water, and digest the mixture at a temperature between 40° and 50° C. (104°–122° F.) until no cloudiness is produced by adding two drops of nitric acid to about 4 mils [old form 61 minims] of the solution. Then filter the peptone solution and neutralize the filtrate with sodium hydroxide previously dissolved in about nine parts of distilled water. Now add the solution of ferric oxychloride and the sodium and manganese citrates, previously dissolved in 75 mils [old form 2 fl. oz. 192 min.] of distilled water with the aid of heat, and warm the mixture until the precipitate has dissolved. When cold add the vanillin, acetic ether, and oil of orange, previously dissolved in the alcohol. Finally add the syrup, glycerin and sufficient distilled water to make the product measure 1000 mils [old form 2 pints].

In this preparation the solution of ferric oxychloride should be carefully and freshly made and in the solution of the precipitate of iron peptonate a boiling temperature is often required.

Uses.—It combines the tonic properties of iron and manganese in a pleasantly flavored solution; the dose is two fluidrachms (8 mils).

LIQUOR FERRI PROTOCHLORIDI. N. F. **Solution of Ferrous Chloride**

[**Liq. Ferr. Protochlor.**—Solution of Protochloride of Iron]

	Metric	Old form
Iron, in the form of fine, bright, and finely cut wire	160 Gm.	5 oz. av. 149 gr.
Hydrochloric Acid	625 Gm.	20 oz. av. 378 gr.
Glycerin	250 mils	8 fl. oz.
Diluted Hypophosphorous Acid	10 mils	154 min.
Distilled Water, a sufficient quantity,		
To make	1000 mils	2 pints

To the iron contained in a flask, add 350 mils [old form 11 fl. oz. 96 minims] of distilled water, and the hydrochloric acid, and apply a gentle heat until effervescence ceases. Then heat the liquid to boiling, keep it at this temperature for a short time so that the iron may be brought into solution as far as possible, and filter the solution through a pellet of purified cotton placed in the neck of a funnel, washing the flask and cotton with a little distilled water. Evaporate the filtrate on a steam bath until crystals begin to form, and the escaping vapors cease to redden, or only slightly affect, moistened blue litmus paper. Now add the glycerin and the diluted hypophosphorous acid, continue the heat, if necessary, until the crystals are redissolved; when the liquid is cool, add sufficient distilled water to make the product measure 1000 mils [old form 2 pints].

This solution is preserved from oxidation through the use of hypophosphorous acid.

Uses.—Used to make the syrup of ferrous chloride and as an iron tonic, in doses of five to ten minims (0.3–0.6 mil).

LIQUOR FERRI SALICYLATIS. N. F. **Solution of Ferric Salicylate**

[**Liq. Ferr. Sal.**—Salicylated Mixture of Iron]

	Metric	Old form
Sodium Salicylate	125.0 Gm.	4 oz. av. 76 gr.
Tincture of Ferric Citro-Chloride	125.0 mils	4 fl. oz.
Ammonium Carbonate	6.5 Gm.	95 gr.
Citric Acid	8.5 Gm.	124 gr.
Methyl Salicylate	2.0 mils	31 min.
Glycerin	175.0 mils	5 fl. oz. 288 min.
Distilled Water, a sufficient quantity,		
To make	1000 mils	2 pints

Dissolve the citric acid in 200 mils [old form 6 fl. oz. 192 min.] of distilled water, add the ammonium carbonate and dissolve the sodium salicylate in this solution. Then add the tincture of ferric citro-chloride, glycerin and the methyl salicylate, and, after mixing, sufficient distilled water to make the product measure 1000 mils [old form 2 pints] and filter.

Uses.—Ferric citrate, ordinarily insoluble, is soluble because of the ammonium citrate present in this solution. It is administered in doses of one to two fluidrachms [4 to 8 mils].

FERRI PYROPHOSPHAS. N. F. Ferric Pyrophosphate

[**Ferr. Pyrophos.**—Soluble Ferric Pyrophosphate]

It contains Ferric Pyrophosphate corresponding to not less than 10 per cent. of Fe. Preserve it in well-closed containers, protected from light.

Preparation.—It may be prepared by dissolving sodium pyrophosphate in a strong solution of an equal weight of ferric citrate, evaporating at not over 60° C. (140° F.) to syrupy consistence and scaling.

Official Description.—It occurs in thin, apple-green, transparent scales. The salt is permanent in dry air, when protected from light, but when unprotected soon becomes discolored.

Odor, Taste, and Reaction.—Without odor, and having an acidulous, slightly saline taste. An aqueous solution of the salt is slightly acid to litmus.

Solubility.—It is freely and completely soluble in water; insoluble in alcohol.

Tests for Identity.—Ferric Pyrophosphate, when boiled with sodium hydroxide T.S., produces a brownish-red precipitate without evolving ammonia.

Fuse 0.1 Gm. of the salt with 0.1 Gm. each of potassium nitrate and sodium carbonate, boil the residue with 10 mils of distilled water and filter. The filtrate, after being rendered nearly, but not quite, neutral with highly dilute nitric acid, yields a yellow precipitate on the addition of silver nitrate T.S.

Impurities and Tests for Impurities.—*Phosphate.*—Boil an aqueous solution of the salt (1 in 10) with an excess of sodium hydroxide T.S. until the iron is precipitated, filter, strongly acidulate the filtrate with hydrochloric acid and cool a portion of the liquid. This liquid, when mixed with an equal volume of magnesia mixture T.S., followed by a slight excess of ammonia water, yields a finely divided white precipitate, which, after collecting on a filter and washing, does not turn yellow when treated with a few drops of silver nitrate T.S.

Assay.—Dissolve about 1 Gm. of Ferric Pyrophosphate, accurately weighed, in 25 mils of distilled water and 15 mils of hydrochloric acid, in a glass-stoppered bottle, add 2 Gm. of potassium iodide, securely stopper the bottle, keep it at a temperature of 40° C. (104° F.) for thirty minutes, cool and then titrate the liberated iodine with tenth-normal sodium thiosulphate V.S., using starch T.S. as indicator. It shows not less than 10 per cent. of Fe. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.005584 Gm. of Fe. Each gramme of Ferric Pyrophosphate corresponds to not less than 17.9 mils of tenth-normal sodium thiosulphate V.S.

N. F. Preparations.—Elixir Ferri Pyrophosphatis; Elixir Ferri Pyrophosphatis, Quininæ et Strychninæ.

Uses.—This is one of the best of the mild ferruginous preparations. It is very largely used on account of its solubility and the ease with which it can be administered either in pills or in solution. The dose is two to five grains (0.13 to 0.32 Gm.).

FERRI OXIDUM SACCHARATUM. N. F. Saccharated Ferric Oxide

[**Ferr. Oxid. Sacch.**—Soluble Ferric Oxide Ferrum Oxydatum Saccharatum Eisenzucker]

Saccharated Ferric Oxide contains the equivalent of not less than 2.8 per cent. of Fe.

	Metric	Old form
Solution of Ferric Chloride	300 Gm.	2 oz. av. 175 gr.
Monohydrated Sodium Carbonate	112 Gm.	392 gr.
Water	3000 mils	about 1½ pints
Sodium Hydroxide,		
Sugar, in powder, each, a sufficient quantity,		
To make	1000 Gm.	8 oz. av.

Dilute the solution of ferric chloride with 1500 mils [old form about 12 fl. oz.] of water and gradually add, with constant stirring, a solution of the monohydrated sodium carbonate in the remainder of the water. Wash the precipitate with water by decantation or siphoning until the washings, when diluted with *five volumes* of water, give only a slight opalescence with silver nitrate T.S. Then collect the precipitate on a cloth strainer, press it out, transfer the magma to a porcelain dish on a water bath, add 500 Gm. [old form 4 oz. av.] of sugar and a sufficient quantity (not more than 50 Gm.) of a 15 per cent. solution of sodium hydroxide to produce a clear solution. Evaporate the mixture to dryness on a water bath and if necessary add sufficient sugar to make the product weigh 1000 Gm. [old form 8 oz. av.].

Assay.—Dissolve about 8 Gm. of Saccharated Ferric Oxide, accurately weighed, in 50 mils of diluted hydrochloric acid; add 4 Gm. of potassium iodide and allow the solution to stand for thirty minutes at a temperature of 40° C. (104° F.). Cool the solution, dilute it with 100 mils of distilled water and titrate the liberated iodine with tenth-normal sodium thiosulphate V.S., using starch T.S. as an indicator. It shows not less than 2.8 per cent. of Fe. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.005584 gramme of Fe. Each gramme of Saccharated Ferric Oxide corresponds to not less than 5.01 mils of tenth-normal sodium thiosulphate V.S.

Uses.—This is a preparation of the German and Austrian Pharmacopœias and is a mild chalybeate. The dose is ten to thirty grains (0.65–2 Gm.).

Chromium. Cr; 52.0

Chromium occurs in nature as chrome-iron ore, deposits of which are found in Southeastern Pennsylvania. It has been prepared by reducing Cr_2O_3 with carbon in the electric furnace, also by the aluminothermic process whereby chromium oxide is reduced by finely powdered aluminum, when they are mixed and ignited. This metal is brittle, of a grayish-white color, and very hard, being capable of scratching glass. Its specific gravity is about 6.8. It forms five compounds with oxygen: 1. Monoxide, or *Chromous oxide,* CrO. 2. *Trichromic tetroxide,* Cr_3O_4. 3. Sesquioxide, or *chromic oxide,* Cr_2O_3. 4. *Dioxide,* CrO_2. 5. *Chromium trioxide,* CrO_3. The latter alone and its salts are of pharmaceutical interest.

Tests for Chromium Salts

1. Ammonium sulphide precipitates from solutions of chromium salts a greenish precipitate of chromic hydroxide.

2. Sodium or potassium hydroxide also produces a precipitate of chromic hydroxide, soluble in excess.

3. Soluble lead salts produce yellow precipitates of lead chromate (chrome yellow).

U. S. P. Salts of Chromium

Official Name	Preparation
Chromii Trioxidum	Made by decomposing potassium dichromate with sulphuric acid
Potassii Dichromas (among reagents)	Made by removing one-half of the potassium from potassium chromate with sulphuric acid, evaporating and crystallizing (see Chapter LXII)

Unofficial Salts of Chromium

Chromii Bromidum, Cr_2Br_6 Chromium Bromide	By passing bromine vapor over an ignited mixture of chromic oxide with charcoal and starch paste
Chromii Chloridum, $CrCl_3$ Chromium Chloride	By passing chlorine over heated chromium. Used as a mordant in calico printing
Chromii Dichloridum, $CrCl_2$ Chromium Dichloride	By passing dry chlorine gas over a red-hot mixture of charcoal and chromic oxide

Unofficial Salts of Chromium—*Continued*

Chromii Fluoridum, CrF_3+4H_2O Chromium Fluoride	By treating chromic oxide, dried, but not ignited, with excess of hydrofluoric acid, and heating the dried mass very strongly in a platinum crucible. Used as a mordant
Chromii Iodidum, Cr_2I_6 Chromium Iodide	By treating silver chromate with hydriodic acid and alcohol
Chromii Oxidum, Cr_2O_3 Chromic Oxide	By heating ammonium dichromate to redness. Used in coloring glass and porcelains green
Chromii Sulphas, $Cr_2(SO_4)_3+5H_2O$ Chromium Sulphate (Green)	By dissolving chromic oxide in strong sulphuric acid at a temperature between 50° and 60° C. (122°–140° F.)

CHROMII TRIOXIDUM. U. S. Chromium Trioxide

[Chrom. Triox.—"CHROMIC ACID" CHROMIC ANHYDRIDE]

It contains not less than 95 per cent. of CrO_3 (100.00). Preserve it in glass-stoppered bottles. CAUTION: Chromium Trioxide should not be brought into contact with organic substances, as serious accidents are liable to result.

Preparation.—Chromium trioxide, or chromic acid, as it is usually called, is readily obtained by mixing one hundred volumes of a cold saturated solution of potassium dichromate with one hundred and fifty volumes of sulphuric acid, and allowing the mixture to cool. The sulphuric acid unites with the potassium, and sets free the chromium trioxide, which is deposited in crystals. The mother liquor having been poured off, these are transferred to a glass funnel, and the mother liquor displaced by nitric acid; they are then placed upon a porous tile to drain, and finally dried at from 60° to 80° C. (140° to 176° F.) to remove nitric acid.

$$\underset{\substack{\text{Potassium}\\\text{Dichromate}}}{K_2Cr_2O_7} + \underset{\substack{\text{Sulphuric}\\\text{Acid}}}{2H_2SO_4} = \underset{\substack{\text{Chromium}\\\text{Trioxide}}}{2CrO_3} + \underset{\substack{\text{Acid Potassium}\\\text{Sulphate}}}{2KHSO_4} + \underset{\text{Water}}{H_2O}$$

Official Description.—It occurs as small, needle-shaped crystals or rhombic prisms, of a dark purplish-red color and metallic luster; destructive to animal and vegetable tissues; deliquescent in moist air.

Odor.—Odorless.

Solubility.—One Gm. of Chromium Trioxide dissolves in 0.6 mil of water at 25° C. (77° F.); also in 0.5 mil of boiling water; when brought into contact with organic solvents (*e.g.*, alcohol), decomposition takes place, sometimes with dangerous violence.

Tests for Identity.—When Chromium Trioxide is heated, it darkens, and finally becomes black, but the color is restored on cooling. At about 193° C. (379.4° F.) it fuses to a reddish-brown liquid, which, on cooling, forms a dark red, brittle mass (often enclosing cavities filled with crystals), furnishing a scarlet powder. Above 250° C. (482° F.) it begins to decompose into green chromic oxide and free oxygen, and, after protracted heating, leaves a residue of chromic oxide.

Impurities and Tests for Impurities.—*Sulphuric Acid.*—When warmed with hydrochloric acid, chlorine is evolved. A solution of 1 Gm. of Chromium Trioxide in 100 mils of distilled water, previously acidulated with 3 mils of hydrochloric acid, is not rendered turbid within one minute on the addition of 1 mil of barium chloride T.S.

Assay.—Dissolve about 1 Gm. of Chromium Trioxide, accurately weighed, in a stoppered weighing-bottle, in sufficient distilled water to make a volume of 100 mils. Mix 15 mils of this solution with 3 mils of hydrochloric acid and 2 Gm. of potassium iodide in a glass-stoppered container, agitate the mixture, allow it to stand for five minutes, then dilute it with 100 mils of distilled water and titrate with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator. It shows not less than 95 per cent. of CrO_3. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.003333 Gm. of CrO_3. Each gramme of Chromium Trioxide corresponds to not less than 285.0 mils of tenth-normal sodium thiosulphate V.S.

Uses.—Chromium trioxide is a powerful caustic and antiseptic; it parts with its combined oxygen with great facility. It is a very effective caustic in destroying warty growths. It is not used internally.

POTASSII DICHROMAS. U. S. Potassium Dichromate

For a description of this chromium salt, see the reagents, Chapter LXII.

Uranium. U; 238.5

Uranium occurs in nature chiefly in the mineral *uraninite* (*uranite*) or *pitch-blende*, U_3O_8. It may be prepared by heating the oxide with sugar charcoal in the electric furnace. It is a white, malleable metal, fairly hard but softer than steel. Its specific gravity is very high; 18.7. In contact with air it tarnishes slowly. It is closely related chemically to chromium, molybdenum, and tungsten and two classes of compounds, *i.e. uranous*, derived from the oxide UO_2, and *uranyl*, containing the divalent group UO_2. It is especially well known because of its connection with radium. Becquerel, in 1896, discovered that pitch-blende emitted special radiations, capable of influencing a photographic plate, and he attributed these properties to uranium, but in 1898 and 1899 Madame Curie and her husband Professor Curie showed that these properties were not due to the presence of uranium but to another substance to which they gave the name radium.

Uranium compounds are used in glass manufacture to produce a greenish-yellow glass, known as uranium glass.

U. S. P. Salt of Uranium

Official Name	Preparation
Uranii Nitras	By dissolving the purified oxide from pitch-blende in nitric acid

Unofficial Salts of Uranium

Name	Preparation
Uranous Sulphate, $U(SO_4)_2+4H_2O$	By dissolving uranous oxide in sulphuric acid
Uranyl Acetate, $UO_2(C_2H_3O_2)_2+2H_2O$	By dissolving uranium oxide in 30 per cent. acetic acid
Uranyl Sulphate $(UO_2)SO_4+3H_2O$	By decomposing the nitrate with sulphuric acid

URANII NITRAS. U. S. Uranium Nitrate

[Uran. Nit.]

It contains not less than 98 per cent. of $UO_2(NO_3)_2+6H_2O$ (502.62) (uranyl nitrate). Preserve it in well-closed containers, protected from light.

Official Description.—It occurs in the form of light yellow prisms; somewhat efflorescent; radio-active.

Odor, Taste, and Reaction.—Odorless and having a bitter, astringent taste. Aqueous solutions of Uranium Nitrate are yellow and acid to litmus.

Solubility.—One Gm. of Uranium Nitrate dissolves in 1.2 mils of water at 25° C. (77° F.); freely soluble in alcohol or ether.

Tests for Identity.—Separate portions of an aqueous solution of the salt (1 in 20) yield, with sodium hydroxide T.S. or ammonia water, a yellow precipitate insoluble in an excess of the reagent but soluble in ammonium carbonate T.S.; with ammonium sulphide T.S. a dark brown precipitate; and with sodium phosphate T.S. a yellow precipitate. Mix 2 mils of the aqueous solution with an equal volume of sulphuric acid, cool the mixture, and add a crystal of ferrous sulphate; a dark brown color appears around the crystal.

Impurities and Tests for Impurities.—*Heavy Metals.*—An aqueous solution of the salt does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Alkaline Earths.—An aqueous solution of the salt (1 in 20) remains clear after the addition of an equal volume of ammonium carbonate T.S.

Iron, Manganese, or Zinc.—Dilute 3 mils of this mixture to 10 mils with distilled water and add 10 mils of hydrogen sulphide T.S.; no color or precipitate is produced.

Uranous Compounds.—A solution of 1 Gm. of Uranium Nitrate in 20 mils of distilled water, acidulated with 1 mil of diluted sulphuric acid, does not completely decolorize 0.1 mil of tenth-normal potassium permanganate V.S.

Sulphate.—An aqueous solution of the salt (1 in 100) does not at once produce a turbidity with barium chloride T.S.

Assay.—Dissolve about 0.4 Gm. of the salt, accurately weighed, in 100 mils of distilled water, heat the solution to boiling, add ammonia water until no further precipitate is produced, and allow the precipitate to settle. Then wash the precipitate well on a filter with an aqueous solution of ammonium nitrate (1 in 100), and afterwards moderately ignite it in a platinum crucible, with free access of air, until the weight is constant. The urano-uranic oxide (U_3O_8) so obtained corresponds to not less than 54.8 per cent. of the weight of the salt taken, which is equivalent to not less than 98 per cent. of $UO_2(NO_3)_2+6H_2O$.

Uses.—Use with caution. It has been used in the treatment of diabetes. The dose is one-sixth grain (0.01 Gm.).

QUESTIONS ON MANGANESE, IRON, CHROMIUM, AND URANIUM

Manganese—Give Latin name, symbol, and atomic weight. (See page 854.)
How is it found?
How many compounds does it form with oxygen?
Give their names and chemical composition.
What are the tests for the salts of manganese?
Precipitated manganese dioxide—What is it?
How may the official dioxide be prepared?
How much per cent. of pure manganese dioxide should it contain?
Does the commercial article always contain this much?
How may its quality be tested?
Describe odor, taste, and chemical reaction.
How may insoluble substances be detected?
Soluble Manganese Citrate—What is its synonym? What is its composition? Describe its appearance, odor, taste and solubility. What are the tests for identity and purity? What are its uses and the dose?
Soluble manganese glycerophosphate—What is its composition? Give the synonym. Describe its appearance, odor, taste, reaction and tests for identity. What impurities are likely to be present and how detected? What are its uses and dose?
Manganese hypophosphite—What is the Latin title and formula in symbols? Give the description, odor, taste, chemical reaction and solubility. Give the tests for identity.
How may the following impurities be detected?—Carbonate; phosphate; sulphate; calcium; arsenic.
For what is this salt used and in what dose?
Manganese sulphate—Give Latin name and formula in symbols.
Give Prof. Diehl's process for making this salt.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Iron; chlorides; heavy metals; salts of alkalies; zinc. For what is it used medicinally?
What is the dose?
Potassium permanganate—Give Latin name.
Iron—Give Latin name, symbol, and atomic weight.
With which of the non-metallic elements does it not combine?
What compounds does it form with oxygen?
What are the tests for iron salts?
In what forms is iron official?
Why is wire often used as the source of iron in pharmaceutical preparations?
What other forms of waste material or by-product is used for official iron?
Reduced iron—Give Latin name.
Describe Prof. Procter's process for making it.
How may its quality be tested?
Describe appearance, odor, taste, and chemical reaction.
How may the following impurities be detected?—Sulphide; arsenic.
For what is it used medicinally and in what dose?
Saccharated ferrous carbonate—Give Latin name. What is the dose?
How is it prepared?

Describe odor, taste, chemical reaction, and solubility.
How may impurity of sulphate be detected?
What is the dose?
Mass of ferrous carbonate—Give Latin name and synonym.
How is it made?
Why are syrup and honey used in this preparation?
Ferric chloride—Give Latin name, formula in symbols, and molecular weight.
Is this a ferrous or a ferric salt?
What other names are used for this salt?
How is it made?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
What impurities are likely to be present and how may they be detected?
What are the uses of this salt and its dose?
Ferric hydroxide with magnesium oxide—Give the Latin title and synonyms.
How should it be kept for use?
What are its uses?
Syrup of ferrous iodide—How much ferrous iodide does it contain?
How is it made? How preserved?
What is the object of exposing this syrup to the light?
Describe its appearance, taste and chemical reaction.
Give the specific gravity and test for identity.
How may free iodine be detected?
Describe the assay.
What is the dose, and how should it be taken?
Ferric phosphate—What are its synonyms? How is it made?
Solution of ferric chloride—Give Latin name.
How much anhydrous ferric chloride does it contain?
How is it made?
If this solution when finished has a blackish color, what is indicated? What is the remedy?
If a brown precipitate occurs upon dilution or standing, what is indicated? What is the remedy?
Describe appearance, odor, taste, chemical reaction, and state specific gravity.
Give tests for identity.
How may the following impurities be detected?—Zinc, lead, or copper; salts of fixed alkalies; nitric acid; ferrous salts; excess of free hydrochloric acid.
What are its chief uses and the dose?
Tincture of ferric chloride—Give Latin name.
How is this tincture prepared?
What is the object of allowing the mixture to stand three months before it is to be used?
If a brownish-red precipitate occurs upon diluting the solution of ferric chloride, what is indicated?
Describe its appearance, odor, taste, chemical reaction. Give the specific gravity and tests for identity.
How may the presence of nitric acid be detected?
For what is it used medicinally and in what dose?
Iron and ammonium citrate—Give Latin name.
By what other names is it known?
How is it prepared?
What is Lloyd's modification of this process?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may tartrate as an impurity be detected?
What is the dose?
Iron and quinine citrate—Give Latin name.
How is it prepared?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
Describe the assay for quinine; also for iron.
What is the dose?
Is this a definite chemical compound?
What other salt does it closely resemble?

Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
What are its uses and the dose?
Ferrous sulphate—Give Latin name, synonym, formula in symbols, and molecular weight.
What is the British process for making this salt?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Heavy metals; free acid.
What is the popular name of the impure ferrous sulphate?
How much water of crystallization do the crystals contain?
For what is this salt used? What is the dose?
Exsiccated ferrous sulphate—Give Latin name, formula in symbols, and molecular weight.
What other title or name is used?
How is it prepared?
How many parts of the exsiccated salt will one hundred parts of the crystallized salt make?
Granulated ferrous sulphate—Give Latin name, synonym, and formula in symbols.
Does this differ in composition from "ferri sulphas"?
How is it prepared?
What is the use of alcohol in this formula?
What advantages does this powder possess over the ordinary form of crystals?
Solution of iron and ammonium acetate—What is the Latin name?
How is it made? What is its popular name?
Describe appearance, taste, odor and reaction.
Why should this solution be acid?
Give specific gravity and tests for identity.
What is the dose?
Solution of ferric subsulphate—Give Latin name.
What synonym has this solution?
How much basic ferric sulphate does it contain?
How is it prepared? Give description and specific gravity.
Describe appearance, odor, taste, and chemical reaction. Give tests for identity.
How may the following impurities be detected?—Nitric acid; ferrous salt.
What are its uses and the dose?
Solution of ferric tersulphate—What is the Latin name?
What sulphate of iron does this solution contain, and how much?
How is it made?
Wherein does this solution differ from the solution of ferric subsulphate?
Describe appearance, odor, taste, and chemical reaction. Give tests for identity.
How may the following impurities be detected?—Nitric acid; ferrous salt.
For what is this solution used?
Ferric hydroxide magma—What is the common name? How is it made? What are its uses?
Solution of ferric acetate—How is it made? Give uses and dose.
Solution of albuminate of iron—How is it prepared? What are the uses and dose?
Solution of ferric citrate—What is the official strength?
How is it prepared? Give uses and dose.
Ferric glycerophosphate—What is its synonym? How may it be made?
Describe appearance, odor, taste, reaction, and tests for identity.
What impurities are likely to be present and how may they be detected? For what it is used? Give the dose.
Ferric hypophosphite—How may it be prepared? Describe its appearance, odor, taste, solubility, and tests for identity.
What impurities are likely to be present and how may they be detected? What are its uses and the dose?
Solution of ferric hypophosphite—How is it made? Give the use and dose.
Ferrous lactate—How may it be made? Describe its appearance, odor, taste, solubility, and tests for identity. What impurities are likely to be present and how may they be detected? What are its uses and dose?
Solution of ferric nitrate—What is its strength? How is it prepared? What are its uses and the dose?
Solution of ferric oxychloride—How is it prepared? What are its uses and dose?

Solution of ferric oxysulphate—How is it prepared?
Solution of peptonate of iron—How is it made? What special precautions are necessary? What are its uses and the dose?
Solution of peptonate of iron and manganese—How is it prepared? Give its uses and dose.
Solution of ferrous chloride—What is its synonym? How is it made? Give the uses and dose.
Solution of ferric salicylate—How is it prepared?
How is ferric salicylate made soluble? Give the uses and its dose?
Ferric pyrophosphate—What is the synonym?
How may it be prepared? Describe appearance, odor, taste, reaction, solubility, and tests for identity. If phosphate is present, how may it be detected? Give its uses and dose.
Saccharated ferric oxide—Give the synonyms. How is it prepared?
What are its uses and the dose?
Chromium—What is its formula in symbols? What is its molecular weight?
How does it occur in nature, and whence is it obtained?
What compounds does it form with oxygen?
What are the tests for chromium salts?
Chromium trioxide—What is the Latin name?
What are the synonyms?
What is its formula in symbols?
How is it obtained?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurity of sulphuric acid be detected?
What are its uses?
Why should care be used in mixing it with deoxidizing bodies?
Potassium dichromate—What is the Latin official title?
Uranium—What is its chemical symbol and molecular weight? How is it obtained and what special peculiarity does the ore possess? To what element is this due?
Uranium nitrate—Describe appearance, odor, taste, solubility and tests for identity. What impurities are likely to be present and how detected? Give its uses and dose.

CHAPTER XLV

NICKEL, COBALT, AND TIN

Ni; 58.68. Co; 58.97. Sn; 119.0

None of these metals nor any of their compounds are considered of sufficient medicinal importance to give them a place in the U. S. Pharmacopœia. Their salts are sometimes used medicinally, and several are among the official reagents. Two of the metals, nickel and tin, are important in many respects, particularly in the arts.

Nickel. Ni; 58.68

This metal has been found in magnetic pyrites in Pennsylvania, but the mines are now practically exhausted; also as arsenic or *kupfernickel* in Germany and Sweden, and as a mixed silicate called *garnierite* (or *genthite*) 2 (Ni.Mg) $Si_4O_{13}+2H_2O$ in New Caledonia, Nova Scotia, and Norway. Its specific gravity is 8.9. It is a white, malleable metal, and forms with copper a valuable alloy, known as *German silver*. This alloy is also used for making coins, for plating other metals, for manufacturing scale pans and laboratory utensils and for many other purposes. Some of the salts have come into use as medicines; the Latin name of the metal is *Niccolum*.

Tests for Compounds of Nickel

1. Ammonium sulphide produces with a solution of a nickel salt a black precipitate (sulphide), insoluble in diluted hydrochloric acid, but soluble in hot nitric acid.

2. Potassium or sodium hydroxide produces with nickel salts pale green precipitates of hydroxide insoluble in an excess.

3. Potassium cyanide produces a green precipitate with a solution of a nickel salt, soluble in an excess, but reprecipitated by hydrochloric acid.

Unofficial Salts of Nickel

Niccoli Bromidum, $NiBr_2$ Nickel Bromide	By dissolving nickel carbonate in hydrobromic acid, concentrating, then crystallizing
Niccoli Carbonas, $NiCO_3$ Nickel Carbonate	By heating nickel chloride with an alkaline carbonate in sealed tubes and collecting the powder
Niccoli Chloridum, $NiCl_2$ Nickel Chloride	By heating nickel filings to low redness in a stream of chlorine
Niccoli Cyanidum, $Ni(CN)_2$ Nickel Cyanide	By adding to a solution of potassium cyanide a solution of any nickel salt in slight excess and collecting the precipitate
Nickelous Oxide, NiO	By heating the nitrate or hydroxide
Nickelic Oxide, Ni_2O_3	Formed by the action of a hypochlorite on a nickel salt
Niccoli Sulphas, $NiSO_4+7H_2O$ Nickel Sulphate	By dissolving pure nickel carbonate in diluted sulphuric acid, concentrating the solution, then crystallizing
Nickel Sulphide, NiS	By adding alkali sulphides to solutions of soluble salts of nickel

Cobalt. Co; 58.97

This metal is usually found associated with arsenical ores in *cobaltite*, $CoAs_2.CoS_2$, and *smaltite*, $CoAs_2$. It is white, tough, and brittle, unalterable in the air, and strongly magnetic. Sp. gr. 8.5. It forms two classes of salts, cobaltous and cobaltic, in this respect resembling iron. The native ore *skutterudite*, $CoAs_3$, and other cobalt minerals containing arsenic, are often sold in commerce under the name of *fly-*

stone. It is used as a fly-poison by breaking it into small fragments and mixing them with sweetened water. The *chloride* and *sulphocyanate* have been used to make *barometer paper*, by dipping ordinary white paper into a solution and drying it; when dry the color is blue, but an increase of moisture in the air changes the color to pink. Salts of cobalt are used to give glass a blue color.

Cobaltous chloride is used officially as a reagent (see Chapter LXII). No other salts are official, and none of the unofficial salts are of pharmaceutical interest.

Tests for Salts of Cobalt

1. Ammonium sulphide produces in a solution of a cobaltous salt a black precipitate (sulphide), insoluble in diluted hydrochloric acid.
2. Solution of potassium hydroxide produces with a solution of a cobaltous salt a blue precipitate, changing by heat first to a violet and subsequently to a red color.
3. Potassium cyanide produces a yellowish-brown precipitate, soluble in an excess; the clear solution after being boiled does not afford a precipitate with hydrochloric acid (difference from nickel salts).

Tin. Sn; 119.0

The sulphide and oxide (*cassiterite* or *tinstone*, SnO_2) are the forms in which tin is usually found. Tin is a valuable white metal, of a silvery color, which, when bent, emits a peculiar crackling sound, termed the "cry of tin." Its specific gravity is 7.25. It forms two classes of compounds, called *stannous* and *stannic* salts. These are not used to any extent in medicine or pharmacy, but are of great importance in the arts. (Stannous chloride is used officially in the arsenic test. See Test No. 1, Chapter LXII.)

Tests for Compounds of Tin

1. Potassium or sodium hydroxide produces in a solution of a salt of tin a white precipitate (hydroxide), soluble in an excess.
2. Ammonia water produces a white precipitate (hydroxide) with a solution of a stannous salt, nearly insoluble in an excess. The same reagent with a stannic salt produces a similar white precipitate (hydroxide), slightly soluble in an excess.
3. Ammonium sulphide produces in solutions of stannous salts a brownish-black precipitate, soluble in an excess (if an excess of sulphur be present in the reagent). The yellow sulphide is precipitated from this solution on the addition of an acid. Ammonium sulphide with stannic salts produces a yellow precipitate, soluble in an excess.
4. Mercuric chloride in contact with stannous salts is reduced to mercurous chloride or metallic mercury; no change occurs when it is added to stannic salts.

Unofficial Salts of Tin

Stanni Chloridum, $SnCl_2+2H_2O$ Stannous Chloride (tin salt)	By dissolving tin in hot hydrochloric acid
Stanni Hydroxidum, $Sn(OH)_2$ Stannous Hydroxide	By the action of sodium carbonate on a solution of stannous chloride
Stanni Sulphidum, SnS Stannous Sulphide	By passing hydrogen sulphide gas into a solution of stannic chloride
Sodii Stannas, Na_2SnO_3 Sodium Stannate	By boiling tin ore with solution of sodium hydroxide
Acidum Stannicum, H_2SnO_3 Stannic Acid	By precipitating a solution of an alkaline stannate with an acid
Acidum Metastannicum, $H_{10}Sn_5O_{15}$ Metastannic Acid	By acting on tin with nitric acid

CHAPTER XLVI

LEAD, COPPER, SILVER, AND MERCURY

Pb; 207.10. Cu; 63.57. Ag 107.88. Hg; 200.6

This group embraces four well-known metals, which furnish compounds of great value as medicines. They are allied to one another chemically, although they differ greatly in their physical properties.

Lead. Pb; 207.10

Lead is obtained from the native sulphide, *galena,* or *galenite* by roasting in a reverberatory furnace. It is often associated with silver. It is a heavy, soft, ductile, bluish metal, with a specific gravity of 11.37. It melts at 334° C. (633.2° F.). Lead forms five compounds with oxygen: 1. Suboxide, Pb_2O. 2. Monoxide, PbO. 3. Sesquioxide, Pb_2O_3. 4. Dioxide, PbO_2. 5. Triplumbic tetroxide, Pb_3O_4.

Tests for Compounds of Lead

1. Hydrogen sulphide or ammonium sulphide precipitates the insoluble black sulphide from salts of lead.
2. Sulphuric acid or a sulphate causes the precipitation of the white sulphate, insoluble in nitric acid.
3. The alkaline carbonates (sodium, potassium, and ammonium) precipitate lead carbonate, insoluble in an excess.

Poisonous Properties of Lead and its Compounds

Pure water dissolves appreciable quantities of lead through the formation of a slightly soluble hydroxide or carbonate. If traces of sulphates or chlorides are present in the water, an insoluble coating is formed on the surface of the metal, which protects it from further decomposition. Lead pipes and lead tanks for containing drinking water should be used with care (see U. S. Dispensatory, 19th edition, page 976).

U. S. P. Salts and Solutions of Lead

Official Name	Preparation
Plumbi Acetas	Made by treating lead oxide with acetic acid, evaporating, and crystallizing
Liquor Plumbi Subacetatis	By boiling aqueous solution of lead acetate with lead oxide
Plumbi Subacetatis Dilutus	By diluting 40 Gm. of solution of lead subacetate with 960 Gm. of distilled water
Plumbi Oxidum	By roasting lead ore in reverberatory furnaces

N. F. Salts of Lead

Plumbi Carbonas	By subjecting metallic lead to fumes of acetic acid and afterward to carbon dioxide from decaying vegetable matter
Iodidum	By double decomposition between lead nitrate and potassium iodide
Oxidum Rubrum	By carefully heating litharge to about 450° C. (842° F.)

Unofficial Salts and Preparations of Lead

Plumbi Bromidum, $PbBr_2$ Lead Bromide	By making separate solutions of lead acetate and potassium bromide, mixing them, and collecting the precipitate
Plumbi Chloridum, $PbCl_2$ Lead Chloride	By dissolving lead acetate in water and adding hydrochloric acid, then collecting the precipitate
Plumbi Chloris, $Pb(ClO_2)_2$ Lead Chlorite	By making separate solutions of lead nitrate and neutral calcium chlorite, mixing them, and collecting the precipitate

Unofficial Salts and Preparations of Lead—*Continued*

Plumbi Chromas, $PbCrO_4$ Lead Chromate	By making separate solutions of lead nitrate and potassium dichromate, mixing them, and collecting the precipitate
Plumbi Dioxidum, PbO_2 Lead Dioxide	By treating red lead with diluted nitric acid and collecting the insoluble powder
Plumbi Hydroxidum Lead Hydroxide	By mixing solutions of lead acetate and sodium hydroxide and collecting the precipitate
Plumbi Nitras Lead Nitrate	By treating lead oxide with diluted nitric acid, evaporating and crystallizing
Plumbi Saccharas Lead Saccharate	By saturating a solution of saccharic acid in water with freshly precipitated lead carbonate gradually added
Plumbi Sulphas, $PbSO_4$ Lead Sulphate	By dissolving lead nitrate in water and adding sulphuric acid, then collecting the precipitate
Plumbi Tannas Lead Tannate	By adding a solution of tannin to a solution of lead acetate and collecting the precipitate

PLUMBI ACETAS. U.S. Lead Acetate

[Plumb. Acet.—SUGAR OF LEAD]

It contains not less than 85.31 per cent. nor more than 89.57 per cent. of anhydrous lead acetate, corresponding to not less than 99.5 per cent. of the crystallized salt [$Pb(C_2H_3O_2)_2+3H_2O=379.20$]. Preserve it in well-closed containers.

Preparation.—This important salt is made by adding lead oxide to acetic acid and gently heating the mixture until combination takes place.

$$\underset{\text{Lead Oxide}}{PbO} + \underset{\text{Acetic Acid}}{2HC_2H_3O_2} = \underset{\text{Lead Acetate}}{Pb(C_2H_3O_2)_2} + \underset{\text{Water}}{H_2O}$$

The commercial salt is unfit for pharmaceutical uses; it is not expected to be pure, and usually contains both carbonate and oxide. The official salt is thus described:

Official Description.—It occurs as colorless, shining, transparent, monoclinic prisms or plates, or as heavy, white, crystalline masses, or granular crystals; efflorescent, and absorbing carbon dioxide on exposure to the air.

Odor, Taste, and Reaction.—Having a faintly acetous odor, and a sweetish, astringent, afterwards metallic taste. An aqueous solution of Lead Acetate (1 in 10) is slightly alkaline to litmus.

Solubility.—One Gm. of Lead Acetate dissolves in 1.4 mils of water, and in 38 mils of alcohol at 25° C. (77° F.); also in about 0.5 mil of boiling water; freely soluble in glycerin.

Tests for Identity.—When heated to 40° C. (104° F.) the salt loses its water of crystallization. When heated rapidly to 75° C. (167° F.), it fuses in its water of crystallization, and at a temperature above 280° C. (536° F.) it finally decomposes, leaving a residue of finely divided metallic lead mixed with lead oxide.

Separate portions of an aqueous solution (1 in 10) yield a black precipitate with hydrogen sulphide T.S., a yellow precipitate with potassium iodide T.S., and a white precipitate with diluted sulphuric acid.

Add 0.1 Gm. of the salt to a mixture of 1 mil of sulphuric acid and 1 mil of alcohol and warm the mixture; ethyl acetate is formed, recognizable by its odor.

Impurities and Tests for Impurities.—*Carbonate.*—A solution of the salt (1 in 10), prepared with distilled water which has been recently boiled, is clear, or only slightly opalescent and

Iron or Copper.—Yields with potassium ferrocyanide T.S. a precipitate which is not perceptibly blue or red.

Assay.—Dissolve about 5 Gm. of Lead Acetate, accurately weighed, in sufficient recently boiled distilled water to make exactly 100 mils of solution. Mix 10 mils of this solution with 50 mils of tenth-normal oxalic acid V.S. in a 200-mil measuring flask, agitate the mixture thoroughly for five minutes, then fill the flask to the mark with distilled water; filter, and titrate 100 mils of the filtrate (representing one-twentieth of the amount of Lead Acetate originally taken) with tenth-normal potassium permanganate V.S., the filtrate being previously acidulated with 10 mils of sulphuric acid and warmed to 80° C. (176° F.). It shows not less than 85.31 per cent. nor more than 89.57 per cent. of $Pb(C_2H_3O_2)_2$. Each mil of tenth-normal oxalic acid V.S. used corresponds to 0.016257 Gm. of $Pb(C_2H_3O_2)_2$. Each gramme of Lead Acetate corresponds to not less than 52.5 mils nor more than 55.1 mils of tenth-normal oxalic acid V.S.

U. S. P. Preparation.—Liquor Plumbi Subacetatis.

N. F. Preparations.—Liquor Alumini Acetatis; Lotio Plumbi et Opii; Pilulæ Opii et Plumbi.

Uses.—Lead acetate is a valuable astringent and sedative; it is used both internally and externally. The dose is from one to three grains (0.065 to 0.2 Gm.). Its solution in water is usually turbid, due to the formation of a trace of carbonate through the carbonic acid present in the water; diluted acetic acid dissolves this precipitate.

LIQUOR PLUMBI SUBACETATIS. U. S. Solution of Lead Subacetate

[**Liq. Plumb. Subacet.**—GOULARD'S EXTRACT]

An aqueous solution containing lead subacetate, approximately $Pb_2O(CH_3.COO)_2 = 548.25$, corresponding to not less than 18 per cent. of Pb. Preserve the Solution in well-stoppered bottles.

	Metric	Old form
***Lead Acetate**...............................	**180 Gm.**	3 oz. av. 313 gr.
Lead Oxide, finely powdered....................	**110 Gm.**	2 oz. av. 118 gr.
Distilled Water, a sufficient quantity,		
To make	**1000 Gm.**	1 pint

Dissolve the lead acetate in 700 mils [old form about 11½ fl. oz.] of boiling distilled water and add the solution slowly and in portions to the lead oxide, which has previously been rubbed to a smooth paste with 100 mils [old form about 1½ fl. oz.] of distilled water, and place in a porcelain dish of about 1000 mils [old form 1 pint] capacity. Boil this mixture during half an hour with occasional stirring, adding distilled water as required to maintain about the original volume. Finally, when cool, filter the solution, protecting it as much as possible from the air, and add sufficient distilled water, which has previously been boiled and cooled, to make the finished product weigh 1000 Gm. [or measure, old form 1 pint].

The object of this process is to furnish a concentrated solution of a lead compound containing a small proportion of acetic acid. The "subacetate" is not a definite salt, but as found in the official solution it is a mixture of oxyacetates, produced by boiling the normal in water in contact with the oxide.

$$\underset{\text{Lead Oxide}}{3PbO} + \underset{\text{Lead Acetate}}{3Pb(C_2H_3O_2)_2} = \underbrace{Pb_3O(C_2H_3O_2)_4 + Pb_3O_2(C_2H_3O_2)_2}_{\text{Lead Oxyacetates}}$$

The solution is being prepared on a large scale by simply mixing the solution of lead acetate with the lead oxide and frequently agitating the mixture without heat.

After several days the clear portion is decanted and standardized by assay.

Official Description.—A clear, colorless liquid. On exposure to the air it absorbs carbon dioxide, which causes the formation of a white precipitate.

Odor, Taste, and Reaction.—Odorless and having a very sweet, astringent taste. It is alkaline to litmus but not to phenolphthalein.

Specific Gravity.—About 1.245 at 25° C. (77° F.).

Tests for Identity.—*Distinction from Normal Lead Acetate.*—When Solution of Lead Subacetate is added to a solution of acacia, it produces a dense white precipitate.

Separate portions of Solution of Lead Subacetate, diluted with 10 volumes of recently boiled distilled water, yield a black precipitate with hydrogen sulphide T.S., a yellow precipitate with potassium iodide T.S., and a white precipitate with diluted sulphuric acid.

Impurities and Tests for Impurities.—*Iron or Copper.*—Solution of Lead Subacetate yields with potassium ferrocyanide T.S. a precipitate which is not perceptibly blue or red.

Assay.—Transfer about 1.5 Gm. of Solution of Lead Subacetate, accurately weighed, to a 200-mil measuring flask, dilute with 50 mils of recently boiled distilled water, then add 50 mils of tenth-normal oxalic acid V.S., agitate the mixture thoroughly for five minutes, fill to the mark with distilled water, and filter, rejecting the first 20 mils of the filtrate. Add 5 mils of sulphuric acid to 100 mils of the filtrate (representing one-half of the amount of Solution of Lead Subacetate originally taken), warm to about 70° C. (158° F.) and titrate with tenth-normal potassium permanganate V.S. It shows not less than 18 per cent. of Pb. Each mil of tenth-normal oxalic acid V.S. used corresponds to 0.010355 Gm. of Pb. Each gramme of Solution of Lead Subacetate corresponds to not less than 17.4 mils of tenth-normal oxalic acid V.S.

U. S. P. Preparation.—Liquor Plumbi Subacetatis Dilutus.

N. F. Preparations.—Ceratum Plumbi Subacetatis; Mistura Adstringens.

Uses.—This solution, which is frequently termed *Goulard's Extract*, is sedative and astringent; it is employed externally as an application to inflamed surfaces.

LIQUOR PLUMBI SUBACETATIS DILUTUS. U. S. Diluted Solution of Lead Subacetate

[Liq. Plumb. Subacet. Dil.—LEAD WATER]

	Metric	Old form
***Solution of Lead Subacetate**	**40 Gm.**	1 fl. oz. 20 min.
Distilled Water, a sufficient quantity,		
To make	**1000 Gm.**	2 pints

Mix the solution of lead subacetate with enough distilled water, previously boiled and cooled, to make the product weigh 1000 Gm. [or measure, old form 2 pints]. This preparation must be preserved in small, well-filled and tightly stoppered bottles.

This solution will be opalescent, through the formation of a trace of carbonate, if the distilled water used has not been recently boiled and cooled, the object of which is to deprive the water of carbonic acid gas. The addition of a few drops of acetic acid clears the solution by dissolving the precipitate; but, as many serious errors have occurred through the internal use of *lead* water in mistake for *lime* water, it is a good practice to dispense lead water in a slightly opalescent condition and lime water always as a transparent liquid, and, as an additional safeguard, to use blue poison bottles for the lead water.

Uses.—Lead water is used as a soothing application to inflamed surfaces.

PLUMBI OXIDUM. U. S. Lead Oxide

[Plumb. Oxid.—LITHARGE]

It contains, when freshly ignited, not less than 96 per cent. of PbO (223.10). Preserve it in well-closed containers.

Preparation.—Litharge is lead oxide which has been rendered semicrystalline by incomplete fusion. Almost all the litharge of commerce is obtained as a secondary product in the process for extracting silver from argentiferous galenite. After extracting the lead from the ore, the alloy is calcined in the open air, whereby the lead becomes oxidized, and by fusion passes into the state of litharge, while the silver remains unchanged. Litharge is officially described as follows:

Official Description.—It occurs as a heavy, yellowish or reddish-yellow powder, or in minute scales. On exposure to the air it slowly absorbs moisture and carbon dioxide.

Odor, Taste, and Reaction.—Without odor or taste. It imparts a faintly alkaline reaction to water.

Solubility.—Lead Oxide is almost insoluble in water, insoluble in alcohol; dissolved by acetic or diluted nitric acid, and by warm solutions of the fixed alkali hydroxides.

Tests for Identity.—When heated, the Oxide becomes darker in color, but assumes its original color on cooling; it fuses at a red heat. When heated in contact with charcoal, it is reduced to metallic lead.

A solution of the Oxide in diluted nitric acid (1 in 10) is colorless, and, when nearly neutralized by ammonia water, separate portions yield with hydrogen sulphide T.S. a black precipitate, with potassium iodide T.S. a yellow precipitate, and with diluted sulphuric acid a white precipitate.

Impurities and Tests for Impurities.—Shake 5 Gm. of the Oxide in a small flask with 5 mils of distilled water, and add 20 mils of acetic acid. Boil the mixture for a few minutes, filter it, wash the insoluble residue well with diluted acetic acid, and dry it at 110° C. (230° F.); it weighs not more than 0.15 Gm.

Carbonate and Moisture.—When strongly heated in a porcelain crucible, the Oxide loses not more than 4 per cent. of its weight.

Assay.—Dissolve about 0.4 Gm. of freshly ignited Lead Oxide, accurately weighed, in 4 mils of acetic acid and 25 mils of recently boiled distilled water, in a 200-mil graduated flask, and mix the solution with 50 mils of tenth-normal oxalic acid V.S. Fill the flask to the mark with distilled water, mix well, filter through a dry filter into a dry flask, rejecting the first 20 mils of filtrate, and titrate 100 mils of the filtrate (representing one-half of the amount of Lead Oxide originally taken) with tenth-normal potassium permanganate V.S., the filtrate being previously acidulated with 20 mils of diluted sulphuric acid and warmed to 80° C. (176° F.). It shows not less than 96 per cent. of PbO. Each mil of tenth-normal oxalic acid V.S. corresponds to 0.011155 Gm. of PbO. Each gramme of Lead Oxide, after ignition, corresponds to not less than 86.1 mils of tenth-normal oxalic acid V.S.

U. S. P. Preparations.—Emplastrum Plumbi; Liquor Plumbi Subacetatis.

Uses.—Lead Oxide is used in making lead plaster (see Part V).

PLUMBI CARBONAS. N. F. Lead Carbonate
[Plumb. Carb.—White Lead]

A mixture of lead carbonate and hydroxide [approximately $(PbCO_3)_2Pb(OH)_2 = 775.32$].

Preparation.—It is largely prepared by what is known as the Dutch process in which coils of lead are placed in earthenware pots, the lead being supported on ledges above crude pyroligneous acid or vinegar. The pots are perforated just above the vinegar but below the lead. These pots are then placed in stacks and covered with manure or decaying vegetable matter which liberates heat and CO_2 during decomposition. Basic lead acetate is first formed and this is slowly converted into the carbonate. Other processes are used, but, in principle, they are practically identical with that outlined above.

Official Description.—It occurs as a heavy, white, opaque powder, or as a pulverulent mass; permanent in the air.

Odor and Taste.—Without odor or taste.

Solubility.—Insoluble in water or alcohol, but dissolved by acetic acid or diluted nitric acid, with effervescence.

Tests for Identity.—When strongly heated it turns yellow without charring, and when heated in contact with charcoal it is reduced to metallic lead.

Dissolve 2 Gm. of Lead Carbonate in a mixture of 2.5 mils of nitric acid and 40 mils of distilled water; not more than 0.01 Gm. of residue remains. Separate portions of this solution yield a black precipitate with hydrogen sulphide T.S.; a yellow precipitate with potassium iodide T.S.; and a white precipitate with diluted sulphuric acid.

Impurities and Tests for Impurities.—On completely precipitating 10 mils of the solution prepared for the above tests with hydrogen sulphide, the filtrate, on evaporation, leaves not more than 0.01 Gm. of residue.

Ignite 1 Gm. of Lead Carbonate in a porcelain crucible; it leaves a residue of lead oxide weighing not less than 0.83 Gm.

N. F. Preparation.—Liquor Gutta Perchæ.

PLUMBI IODIDUM. N. F. Lead Iodide

(U.S.P. VIII)

[Plumb. Iod.]

It contains not less than 99 per cent. of PbI_2 (460.94). Preserve it in well-closed containers, protected from light.

Preparation.—This iodide may be made by a formerly official British process:

Take of lead nitrate and potassium iodide, each, 4 oz. av.; distilled water, a sufficiency. Dissolve the lead nitrate by the aid of heat, in a pint and a half, and the potassium iodide in half a pint, of the water, and mix the solutions. Collect the precipitate on a filter, wash it with distilled water, and dry it at a gentle heat.

This is an instance of double decomposition, lead iodide and potassium nitrate being formed. The nitrate is preferred to the acetate, because lead iodide is more soluble in solution of potassium acetate than in that of potassium nitrate.

$$\underset{\text{Potassium Iodide}}{2KI} + \underset{\text{Lead Nitrate}}{Pb(NO_3)_2} = \underset{\text{Lead Iodide}}{PbI_2} + \underset{\text{Potassium Nitrate}}{2KNO_3}$$

Official Description.—It occurs as a heavy, bright yellow powder; permanent in the air.

Odor and Taste.—Without odor or taste.

Solubility.—One gramme dissolves in about 1300 mils of water at 25° C. (77° F.) and in about 200 mils of boiling water, separating from the latter solution on cooling in brilliant, golden-yellow crystalline laminæ; very slightly soluble in alcohol; soluble, without color, in solutions of the fixed alkalies, in concentrated solutions of the alkali acetates, of potassium iodide, and of sodium thiosulphate, and in a hot solution of ammonium chloride.

Tests for Identity.—When moderately heated, the salt fuses to a thick, reddish-brown liquid, which congeals, on cooling, to a yellow, crystalline mass. At a higher temperature it is decomposed, with the evolution of violet vapors of iodine, leaving a lemon-yellow residue of lead oxyiodide.

Impurities and Tests for Impurities.—*Chromate and Other Insoluble Foreign Salts.*—Triturate 1 Gm. of the salt with 2 Gm. of ammonium chloride and 2 mils of distilled water; a nearly white mixture results. Transfer this to a test tube, and heat in a water bath for a few minutes; a clear, almost colorless solution is formed. On cooling this solution, a solid mass of nearly colorless, fine, silky crystals is produced, and on adding water or diluted sulphuric acid to this mass, yellow Lead Iodide separates.

Nitrate.—Add 0.1 Gm. of the salt to 5 mils of distilled water, and heat the mixture until it boils; cool the liquid and filter it into a test tube of about 40 mils capacity, then add 5 mils of sodium hydroxide T.S. and about 0.2 Gm. of aluminum wire; insert in the upper portion of the test tube a pledget of purified cotton, and over the mouth place a piece of moistened red litmus paper and then heat the tube on a water bath during fifteen minutes; no blue coloration of the paper will be discernible.

Acetate.—Boil 1.5 Gm. of Lead Iodide for a few minutes with 15 mils of distilled water, cool and filter. To 5 mils of the filtrate add a slight excess of silver nitrate T.S., then a slight excess of hydrochloric acid and filter. Neutralize the filtrate with ammonia water and add a drop of ferric chloride T.S. No red color is produced.

To another 5-mil portion of the filtrate add an excess of hydrogen sulphide T.S., filter, evaporate to dryness and ignite; not more than 0.002 Gm. of residue remains.

N. F. Preparation.—Unguentum Plumbi Iodidi.

Uses.—Lead iodide may be given internally for glandular swelling, in doses of one to three grains (0.065 to 0.2 Gm.), but it is principally used externally in the form of a 10 per cent. ointment for glandular enlargements.

PLUMBI OXIDUM RUBRUM. N. F. Red Oxide of Lead

[Plumb. Oxid. Rub.—RED LEAD]

Lead orthoplumbate ($Pb_2PbO_4 = 685.3$) usually with some unconverted lead monoxide (PbO), corresponding to not less than 31 per cent. of lead dioxide (PbO_2).

Preparation.—By carefully heating litharge (PbO) in a reverberatory or muffle furnace at about 450° C. (842° F.) so that it does not melt, this oxide is formed. It is also prepared by heating litharge with potassium chlorate in an oxidizing flame to a dark red heat.

Official Description.—It occurs as a heavy, orange-red powder. On exposure to the air it slowly absorbs moisture and carbon dioxide.

Odor and Taste.—Without odor or taste.

Solubility.—Almost insoluble in water, insoluble in alcohol, but dissolved by an excess of glacial acetic acid; also dissolved by lactic acid with the evolution of carbon dioxide and the odor of acetaldehyde.

Tests for Identity.—When heated in a porcelain crucible, Red Oxide of Lead at first changes color from red to a violet and then to a blackish tint, and regains its original color on cooling, but, when the heating is continued, it slowly decomposes, forming lead monoxide and oxygen. When heated in contact with charcoal, it is reduced to metallic lead.

Impurities and Tests for Impurities.—*Carbonate.*—Treat 5 Gm. of Red Oxide of Lead with 50 mils of diluted nitric acid; little effervescence results and

Silicate or Lead Sulphate.—A brown, insoluble residue of lead dioxide (PbO_2) remains which, upon the addition of solution of hydrogen dioxide, dissolves with the evolution of oxygen, forming a colorless solution. Boil this solution for fifteen minutes, cool, and filter; the undissolved residue weighs not more than 0.2 Gm.

Separate portions of the solution obtained in the last test yield, with hydrogen sulphide T.S., a black precipitate; with potassium iodide T.S., a yellow precipitate; and with diluted sulphuric acid, a white precipitate; the latter two precipitates being soluble in a solution of sodium hydroxide (1 in 4).

Copper.—From a solution of 0.5 Gm. of Red Oxide of Lead in diluted nitric acid, obtained by the aid of solution of hydrogen dioxide, precipitate the lead with sulphuric acid and filter the mixture. After the addition of an excess of ammonia water this filtrate does not develop more than a slight, bluish tint nor

Iron.—Yields not more than traces of a reddish-brown precipitate.

Soluble Impurities.—Heat a mixture of 1 Gm. of Red Oxide of Lead with 50 mils of distilled water to boiling, cool, and filter. The filtrate is colorless, is not more than faintly alkaline to litmus, and, when evaporated to dryness, leaves not more than 0.01 Gm. of residue.

Assay.—Add about 1 Gm. of Red Oxide of Lead, accurately weighed, to a cool solution of 40 Gm. of crystallized sodium acetate and 2 Gm. of potassium iodide in 50 mils of 50 per cent. acetic acid, agitate the mixture until all of the Red Oxide of Lead has dissolved and then titrate the solution with tenth-normal sodium thiosulphate V.S. It shows not less than 31 per cent. of lead dioxide (PbO_2). Each mil of tenth-normal sodium thiosulphate V.S. corresponds to 0.01195 Gm. of lead dioxide (PbO_2). Each gramme of Red Oxide of Lead corresponds to not less than 25.9 mils of tenth-normal sodium thiosulphate V.S.

N. F. Preparation.—Emplastrum Fuscum Camphoratum.

Uses.—It is largely used as a pigment and also in the preparation of the better grades of flint glass. Officially it is used in the N. F. in making a plaster similar to lead plaster.

Copper. Cu; 63.57

Copper is found naturally in its metallic condition, but chiefly in combination as sulphide or oxide. It is also found as sulphate, carbonate, phosphate, or arsenate. It is a brilliant metal, of a red color, having a specific gravity of 8.92 to 8.95. It forms two oxides: 1. Red cuprous oxide, Cu_2O. 2. Black cupric oxide, CuO.

Tests for Compounds of Copper

1. Hydrogen sulphide or ammonium sulphide produces a black precipitate of cupric sulphide.

2. Ammonia water produces in concentrated solutions of copper salts a pale blue precipitate of cupric hydroxide, in dilute solutions a deep blue coloration.

3. Potassium ferrocyanide produces a reddish-brown precipitate of cupric ferrocyanide.

4. A bright surface of metallic iron or zinc immersed in an acidulated solution of a copper salt is coated with metallic copper.

5. Copper salts color the flame of an alcohol lamp or Bunsen burner green.

U. S. P. Salts of Copper

Official Name	Preparation
Cupri Sulphas	By treating copper with diluted sulphuric acid, evaporating the solution, and crystallizing

Unofficial Salts of Copper

Cupric Ammonium Sulphate	Used as a U. S. P. reagent (see chapter LXII)
Cupric Acetate, $Cu(C_2H_3O_2)_2+H_2O$	By dissolving cupric oxide in acetic acid and purifying the product by crystallization. Used as a U. S. P. reagent (see Chapter LXII)
Cupric Arsenate, $Cu_3As_2O_8+4H_2O$	By adding a solution of copper sulphate to a solution of disodic arsenate, and collecting and drying the precipitate
Cupric Bromide, $CuBr_2$	By evaporating a solution of cupric oxide in aqueous hydrobromic acid, and fusing the residue at a gentle heat
Cupric Chloride, $CuCl_2+2H_2O$	By dissolving cupric oxide in hydrochloric acid and crystallizing
Cupric Citrate	By heating a solution of cupric acetate with citric acid and setting aside to crystallize. Used as an astringent and antiseptic in eye preparations in 5 or 10 per cent. strength. It is rubbed with white petrolatum or dissolved in glycerite of boroglycerin
Cupric Nitrate, $Cu(NO_3)_2$	By dissolving metallic copper in nitric acid and concentrating the solution, then crystallizing
Cupric Oxide, CuO	By continued ignition of copper in contact with air
Cupric Subacetate, $Cu(OH)_2.Cu(C_2H_3O_2)_2$ Verdigris	Made by acting on sheets of copper with acetic acid
Cupric Tartrate	By adding a solution of neutral potassium tartrate to a solution of cupric sulphate and collecting the precipitate. Used as a U. S. P. reagent (see Chapter LXII)
Cuprous Bromide, Cu_2Br_2	By dissolving cuprous oxide in hydrobromic acid.
Cuprous Chloride, Cu_2Cl_2	By dissolving cuprous oxide in hydrochloric acid
Cuprous Iodide, Cu_2I_2	By adding potassium iodide to copper sulphate in the presence of sulphurous acid or ferrous sulphate
Cuprous Fluoride, Cu_2F_2	By dissolving cuprous oxide in hydrofluoric acid.

CUPRI SULPHAS. U. S. Copper Sulphate

[**Cupr. Sulph.**—CUPRIC SULPHATE]

It contains not less than 62.97 per cent. nor more than 66.79 per cent. of anhydrous copper sulphate, corresponding to not less than 98.5 per cent. of the crystallized salt [$CuSO_4+5H_2O=249.72$]. Preserve it in well-closed containers.

Preparation.—This salt is economically made by acting on scrap copper with diluted sulphuric acid, heating, evaporating the solution, and crystallizing.

Official Description.—It occurs as deep blue, triclinic crystals or as a blue, granular powder; slowly efflorescent in dry air.

Odor, Taste, and Reaction.—Odorless, of a nauseous, metallic taste. An aqueous solution of the salt (1 in 20) has a blue color, and is acid to litmus.

Solubility.—One Gm. of Copper Sulphate dissolves in 2.5 mils of water, 500 mils of alcohol, and in 2.8 mils of glycerin at 25° C. (77° F.); also in 0.5 mil of boiling water.

Tests for Identity.—When heated to 30° C. (86° F.) the salt loses part of its water of crystallization and is converted into a pale blue, amorphous powder. More water is lost at 100° C. (212° F.) and finally at 200° C. (392° F.), a white, anhydrous powder remains. At a still higher temperature, sulphur dioxide and oxygen are given off, and a residue of black cupric oxide remains.

Place a drop of an aqueous solution of the salt (1 in 20) on a bright piece of iron; a red film of metallic copper is deposited.

Barium chloride T.S. produces a white precipitate, insoluble in hydrochloric acid, in an aqueous solution of the salt (1 in 10).

Add ammonia water to an aqueous solution of Copper Sulphate (1 in 10), drop by drop; a pale blue precipitate of cupric hydroxide forms, which redissolves in an excess of ammonia water, producing a deep azure-blue solution.

Impurities and Tests for Impurities.—*Other Metals.*—Dissolve 1 Gm. of the salt in 50 mils of distilled water, add 1 mil of diluted hydrochloric acid and pass hydrogen sulphide gas through the solution until all of the copper is precipitated. Upon evaporating the filtrate and igniting, the weight of the residue does not exceed 0.003 Gm.

Assay.—Dissolve about 1 Gm. of Copper Sulphate, accurately weighed, in 50 mils of distilled water and add 4 mils of acetic acid and 3 Gm. of potassium iodide and titrate the liberated iodine with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator. It shows not less than 62.97 per cent. nor more than 66.79 per cent. of $CuSO_4$. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.015964 Gm. of $CuSO_4$. Each gramme of Copper Sulphate corresponds to not less than 39.44 mils nor more than 41.83 mils of tenth-normal sodium thiosulphate V.S.

N. F. Preparations.—Liquor Zinci et Ferri Compositus; Mistura Adstringens.

Uses.—Copper sulphate, called commercially *bluestone* or *blue vitriol*, is used internally as an emetic, in doses of four grains (0.25 Gm.); as an astringent or tonic, from one-fifth to one-half grain (0.01 to 0.03 Gm.) is given. It is used as an injection in gonorrhœa and other diseases, and also as a stimulant wash, and in substance as an escharotic.

Silver. Ag; 107.88

Silver is found in the metallic state, but usually as a sulphide, sometimes associated with lead sulphide, or *galena*. Its sulphide also occurs abundantly as *argentite* or *silver glance*.

Silver is a brilliant white metal, very malleable and ductile, having a specific gravity of 10.4 to 10.6 and melting at 962° C. (1763.6° F.). It forms but one oxide, Ag_2O.

Tests for Silver Salts

1. Hydrochloric acid or any soluble chloride produces with a soluble salt of silver a characteristic, curdy, white precipitate of silver chloride, which is insoluble in hot nitric acid, but soluble in ammonia water.
2. Hydrogen sulphide or ammonium sulphide produces a black precipitate of silver sulphide.
3. Caustic alkalies produce a brown precipitate of silver oxide.

U. S. P. Salts of Silver

Official Name	Preparation
Argenti Nitras	By treating metallic silver with nitric acid, evaporating the solution, and crystallizing
Nitras Fusus	By fusing and moulding silver nitrate
Oxidum	By precipitating solution of silver nitrate with solution of potassium hydroxide

Unofficial Salts of Silver

Argenti Acetas, $AgC_2H_3O_2$ Silver Acetate	By adding a solution of silver nitrate to a solution of sodium acetate, then collecting and drying the precipitate
Argenti Bromidum, $AgBr$ Silver Bromide	By adding to a solution of silver nitrate a solution of potassium bromide, then collecting and drying the precipitate
Argenti Chloridum, $AgCl$ Silver Chloride	By adding to a solution of silver nitrate hydrochloric acid so long as a precipitate is produced, then collecting and drying the precipitate
Argenti Chromas, Ag_2CrO_4 Silver Chromate	By adding a solution of neutral potassium chromate to a solution of silver nitrate, then collecting and drying the precipitate
Argenti Citras, $Ag_3C_6H_5O_7$ Silver Citrate	By adding silver nitrate solution to a neutral solution of sodium citrate, washing and drying the precipitate. The operation should be carried out in the dark
Argenti Cyanidum, $AgCN$ U. S. P. VIII Silver Cyanide	By passing hydrocyanic acid gas into solution of silver nitrate
Argenti Nitras Mitigatus Mitigated Silver Nitrate	By fusing together 30 parts of silver nitrate and 60 parts potassium nitrate
Argenti Iodidum, AgI Silver Iodide	By double decomposition between potassium iodide and silver nitrate. This is largely used as a suspension in acacia, Irish moss or other mucilage in a strength of 2 to 5 per cent. (see Formulary)
Argenti Lactas, $AgC_3H_5O_3+H_2O$ Silver Lactate	By boiling silver carbonate with lactic acid, and collecting and drying the precipitate
Argenti Oxalas, $Ag_2C_2O_4$ Silver Oxalate	By adding a solution of oxalic acid to a solution of silver nitrate, and collecting and drying the precipitate
Argenti Phosphas, Ag_3PO_4 Silver Phosphate	By adding a solution of silver nitrate to a solution of sodium phosphate, and collecting and drying the precipitate
Argenti Sulphas, Ag_2SO_4 Silver Sulphate	By adding a solution of silver nitrate to a solution of sodium sulphate, and collecting and drying the precipitate

Protein and Colloidal Combinations of Silver, Etc.

These combinations of silver lessen the caustic action of silver salts of mineral acids, but retain the germicidal and antiseptic action, although in a less degree.

Albargin Gelatose Silver	By adding silver nitrate solution to a solution of gelatose
Argentamin Ethylene-diamine, Silver Nitrate	By dissolving 10 parts each of silver nitrate and ethylene-diamine
Argonin Casein Silver	By precipitating an alkaline solution of casein with silver nitrate and alcohol
Argyrol Silver Vitellin	By heating freshly precipitated silver oxide with a suspension of vitellin, under pressure, until they combine, and evaporating in vacuo. Vitellin is produced by subjecting serum albumin to electrolytic decomposition
Hegonon Silver Nitrate Ammonia Albumose	By treating silver ammonium nitrate with albumose
Novargan Silver Proteinate	An organic silver albumin compound containing 10 per cent. of silver
Protargol Protein Silver	A combination of albumin and silver containing 8.3 per cent. of silver
Sophol	A combination of silver and methylene nucleinic acid
Cargentos Colloidal Silver Oxide	Colloidal silver oxide with sufficient casein to maintain the silver in colloidal form when in solution. It contains the equivalent of 50 per cent. silver
Collargol Colloidal Silver Argentum Credé	Metallic silver in allotropic form with a small percentage of albumin. It contains the equivalent of about 78 per cent. of silver and forms a colloidal suspension with water
Electrargol	A colloidal suspension of silver, equivalent to 0.25 per cent. of metallic silver, and containing a small amount of sodium arabate

ARGENTI NITRAS. U. S. Silver Nitrate

[Arg. Nit.]

It contains, when finely powdered and dried to constant weight in a desiccator over sulphuric acid, in the dark, not less than 99.8 per cent.

of $AgNO_3$ (169.89). Preserve it in dark amber-colored vials, protected from light.

Preparation.—Mix 3 parts of metallic silver with 10 parts of nitric acid (25 per cent. HNO_3) in a large porcelain dish and warm the mixture until the reaction begins. Invert a funnel over the liquid to prevent spurting of the liquid, and, when the silver is dissolved, rinse the sides of the funnel with a little distilled water. Filter the solution through glass wool, if necessary, and evaporate it on a sand bath to dryness. Then raise the temperature until the salt melts and the nitrous fumes escape, which will soon occur if the silver is pure. If copper is present, as it is likely to be if coin has been used as the source of silver, it being recognized by the bluish color of the solution, it requires longer heating and the reaction is complete when gas no longer escapes and the mass becomes black from the formation of copper oxide. The fused mass is then dissolved in twice its weight of water, filtered and set aside to crystallize. The reaction is as follows:

$$\underset{\text{Silver}}{Ag_3} + \underset{\substack{\text{Nitric}\\\text{Acid}}}{4HNO_3} = \underset{\substack{\text{Silver}\\\text{Nitrate}}}{3AgNO_3} + \underset{\substack{\text{Nitrogen}\\\text{Monoxide}}}{NO} + \underset{\text{Water}}{2H_2O}$$

Official Description.—It occurs as colorless, transparent, tabular, rhombic crystals, becoming gray or grayish-black on exposure to light in the presence of organic matter.

Odor, Taste, and Reaction.—Without odor, but having a bitter, caustic and strongly metallic taste. An aqueous solution of the salt (1 in 10) is clear and colorless and is neutral to litmus.

Solubility.—One Gm. of Silver Nitrate dissolves in 0.4 mil of water and in 30 mils of alcohol at 25° C. (77° F.); also in slightly more than 0.1 mil of boiling water and in 6.5 mils of boiling alcohol; slightly soluble in ether.

Tests for Identity.—When heated in a porcelain crucible to about 200° C. (392° F.) the salt melts, forming a faintly yellow liquid, which, on cooling, congeals to a pure white, crystalline mass. At a higher temperature it is gradually decomposed with the evolution of nitrogen oxides.

Hydrochloric acid added to an aqueous solution of the salt (1 in 50) produces a white, curdy precipitate, insoluble in nitric acid, but readily soluble in ammonia water.

Mix an aqueous solution of the salt (1 in 10) in a test tube with a drop of diphenylamine T.S. and then carefully pour on sulphuric acid so as to form a separate layer; a deep blue color appears at the line of contact.

Test for Impurity.—*Copper.*—An aqueous solution of the salt (1 in 10) is not colored even faintly blue by the addition of an excess of ammonia water.

Assay.—Dissolve about 0.8 Gm. of finely powdered Silver Nitrate, previously dried in a desiccator over sulphuric acid, in the dark, and accurately weighed, in 50 mils of distilled water, add 2 mils of nitric acid and 2 mils of ferric ammonium sulphate T.S. and titrate the mixture with tenth-normal potassium sulphocyanate V.S. It shows, in the dried salt, not less than 99.8 per cent. of $AgNO_3$. Each mil of tenth-normal potassium sulphocyanate V.S. used corresponds to 0.016989 Gm. of $AgNO_3$. Each gramme of Silver Nitrate, dried to constant weight, corresponds to not less than 58.7 mils of tenth-normal potassium sulphocyanate V.S.

U. S. P. Preparation.—Argenti Nitras Fusus.

Uses.—Silver nitrate is used externally as a caustic and escharotic; internally, it is given in gastritis and diarrhœa, in doses of one-fifth to one-half grain (0.01 to 0.03 Gm.).

ARGENTI NITRAS FUSUS. U. S. Moulded Silver Nitrate

[**Arg. Nit. Fus.**—Fused Silver Nitrate Lunar Caustic]

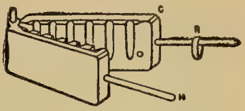
It contains not less than 94.5 per cent. of $AgNO_3$ (169.89).

	Metric	Old form
***Silver Nitrate,** one hundred grammes............	**100 Gm.**	1 oz. av.
Hydrochloric Acid, four grammes	**4 Gm.**	16 min.

Add the hydrochloric acid to the silver nitrate, contained in a porcelain dish, and melt the mixture at as low a temperature as possible. Stir it well, and pour the melted mass into suitable moulds. Preserve it in dark amber-colored vials, protected from light.

When pure fused silver nitrate is cooled, the mass is very brittle, but the addition of hydrochloric acid produces sufficient silver chloride to toughen it, so that the cast cones or sticks will not break so easily. In order to keep the sticks from becoming discolored during the casting process, it is advisable to add a little diluted nitric acid (1 in 5) occasionally to the melted nitrate, and carefully prevent the mass from becoming overheated. Fig. 445 illustrates the silver moulds used in moulding the cones.

Fig. 445



Caustic cone mould

Official Description.—It is a white, hard solid, generally in the form of pencils or cones, showing a fibrous fracture, becoming gray or grayish-black on exposure to light.

Odor, Taste, and Reaction.—Odorless, and having a bitter, caustic, and strong metallic taste. A filtered, aqueous solution of Moulded Silver Nitrate (1 in 10) is neutral to litmus.

Solubility.—One Gm. of Moulded Silver Nitrate, with the exception of about 5 per cent. which is silver chloride, dissolves in 0.4 mil of water and in 30 mils of alcohol at 25° C. (77° F.); also in slightly more than 0.1 mil of boiling water and in 6.5 mils boiling alcohol; slightly soluble in ether.

Tests for Identity and Impurities.—An aqueous solution (1 in 10) responds to the tests for identity and purity under *Argenti Nitras.*

Assay.—Add about 0.8 Gm. of Moulded Silver Nitrate, accurately weighed, to 50 mils of distilled water and, when the silver nitrate has dissolved, filter the solution. Thoroughly wash the filter and sediment with distilled water, add 2 mils of nitric acid and 2 mils of ferric ammonium sulphate T.S. to the mixed filtrate and washings and titrate this liquid with tenth-normal potassium sulphocyanate V.S. It shows not less than 94.5 per cent. of $AgNO_3$. Each mil of tenth-normal potassium sulphocyanate V.S. used corresponds to 0.016989 Gm. of $AgNO_3$. Each gramme of Moulded Silver Nitrate corresponds to not less than 55.6 mils of tenth-normal potassium sulphocyanate V.S.

Uses.—Moulded silver nitrate is used as an escharotic; a good caustic holder may be made from a glass stirring rod of the same diameter as the cone by joining it to the cone with a short length of rubber tubing. The cone may be protected from the action of the air by slipping over it another short length of rubber tubing, having a very short piece of glass rod in the other end as a stopper.

Death has resulted more than once through the careless use of silver nitrate in cauterizing the throat, the cone having slipped out of the fingers and then been swallowed by the patient.

ARGENTI OXIDUM. U. S. Silver Oxide

[Arg. Oxid.]

It contains, when dried to constant weight at 120° C. (248° F.), not less than 99.6 per cent. of Ag_2O (231.76). Preserve it in well-stoppered, dark amber-colored vials. It must not be triturated with readily oxidizable or combustible substances, and must not be brought in contact with ammonia.

Preparation.—This salt may be made as follows by a former official process:

Treat a solution of 10 parts of silver nitrate in 100 parts of distilled water with a solution of sodium hydroxide so long as a precipitate occurs. Then wash the precipitate until free from nitric acid and dry in the dark without heat and preserve it in well-closed containers, protected from light. The reaction is as follows:

$$\underset{\text{Silver Nitrate}}{2AgNO_3} + \underset{\text{Sodium Hydroxide}}{2NaOH} = \underset{\text{Silver Oxide}}{Ag_2O} + \underset{\text{Sodium Nitrate}}{2NaNO_3} + \underset{\text{Water}}{H_2O}$$

Official Description.—It is a heavy, dark brownish-black powder, easily reduced by exposure to light.

Odor and Taste.—Odorless, and having a metallic taste.

Solubility.—Silver Oxide is very slightly soluble in water, to which, however, it imparts an alkaline reaction; insoluble in alcohol; it is dissolved by nitric acid.

Tests for Identity.—When heated in a porcelain crucible to about 250° to 300° C. (482°–572° F.), Silver Oxide is rapidly decomposed, with the evolution of oxygen, leaving a residue of metallic silver.

Impurities and Tests for Impurities.—*Chloride.*—Dissolve about 0.2 Gm. of the Oxide in a mixture of 1 mil of nitric acid and 2 mils of distilled water, add 10 mils of ammonia water and dilute the liquid to 60 mils; 10 mils of this solution does not immediately become cloudy upon the addition of 1 mil of nitric acid.

A solution of the Oxide in nitric acid is colorless, and responds to the tests for identity and purity under *Argenti Nitras* when the tests are applied to a solution of proportionate strength.

Assay.—Dissolve about 0.5 Gm. of Silver Oxide, previously dried to constant weight at 120° C. (248° F.) and accurately weighed, in 3 mils of nitric acid and 50 mils of distilled water in a flask, add 2 mils of ferric ammonium sulphate T.S. and titrate the mixture with tenth-normal potassium sulphocyanate V.S. It shows, in the dried Silver Oxide, not less than 99.6 per cent. of Ag_2O. Each mil of tenth-normal potassium sulphocyanate V.S. used corresponds to 0.011588 Gm. of Ag_2O. Each gramme of Silver Oxide, dried to constant weight, corresponds to not less than 86.0 mils of tenth-normal potassium sulphocyanate V. S.

Uses.—Silver oxide is used as a substitute for silver nitrate, being much less caustic than the latter, and better suited for internal use. It is owing to the facility with which it parts with its oxygen that silver oxide should not be triturated with readily oxidizable or combustible substances, and should not be brought in contact with ammonia. The dose is one grain (0.065 Gm.).

Gelatin capsules are well fitted for dispensing this compound. With most excipients decomposition ensues, and the pills have been known to explode with some violence.

Mercury. Hg; 200.6

Mercury, or quicksilver, is found most abundantly as sulphide, or *cinnabar;* the principal mines are in Spain and California. It is a brilliant, silver-white metal, liquid above —40° C. (—40° F.), and having the specific gravity 13.596. Mercury forms two series of compounds,—*mercurous* and *mercuric*. It is used more largely in medicine in the metallic state than any other element.

Tests for Compounds of Mercury

1. Ammonium sulphide or hydrogen sulphide, in excess, produces a black precipitate (sulphide) in solutions of salts of mercury.
2. Potassium iodide produces with mercurous salts a green precipitate of mercurous iodide, or with mercuric salts a red precipitate of mercuric iodide, soluble in excess.

3. With hydrochloric acid or soluble chlorides a white precipitate of mercurous chloride is produced with mercurous salts, while with mercuric salts no precipitation occurs.

4. A plate of copper or a solution of stannous chloride, in excess, precipitates the metal from its soluble combinations.

U. S. P. Preparations of Metallic Mercury

Official Name	Preparation
Hydrargyrum cum Creta	By extinguishing 38 Gm. of mercury with 10 Gm. of clarified honey and 57 Gm. of prepared chalk
Massa Hydrargyri	By extinguishing 33 per cent. of mercury with oleate of mercury, honey of rose and glycerin, and then adding powdered glycyrrhiza and powdered althæa
Unguentum Hydrargyri	By extinguishing 500 Gm. of mercury with 20 Gm. of oleate of mercury, then adding sufficient melted benzoinated lard and prepared suet to make 1000 Gm.
Hydrargyri Dilutum	By mixing 600 Gm. of mercurial ointment with 400 Gm. of petrolatum

U. S. P. Salts of Mercury

Hydrargyrum Ammoniatum	By precipitating solution of mercuric chloride with ammonia water
Hydrargyri Chloridum Corrosivum	By subliming mercuric sulphate with sodium chloride
Chloridum Mite	By subliming mercuric sulphate and mercury with sodium chloride
Iodidum Rubrum	By double decomposition between mercuric chloride and potassium iodide
Iodidum Flavum	By precipitating an acid solution of mercurous nitrate with potassium iodide
Oxidum Flavum	By precipitating solution of mercurous chloride with sodium hydroxide
Oxidum Rubrum	By decomposing mercuric nitrate by heat
Salicylas	By digesting freshly precipitated mercuric oxide with salicylic acid on a water bath until the mixture is white, washing the precipitated mercuric salicylate and drying

N. F. Solutions

Liquor Hydrargyri et Potassii Iodidi	By dissolving 2.5 Gm. of red mercuric iodide and 2 Gm. of potassium iodide in enough distilled water to make 250 mils
Liquor Hydrargyri Nitratis (U. S. P. VIII)	By dissolving 40 Gm. of red mercuric oxide in a mixture of 45 Gm. of nitric acid and 15 Gm. of distilled water

Unofficial Salts of Mercury

Hydrargyri Acetas, $Hg(C_2H_3O_2)_2$ Mercuric Acetate	By dissolving mercuric oxide in acetic acid, filtering, concentrating, and crystallizing
Hydrargyri Arsenas, $Hg_3(AsO_4)_2$ Mercuric Arsenate	By adding a solution of arsenic acid to a solution of mercuric nitrate, and collecting the precipitate
Hydrargyri Benzoas Mercuric Benzoate	Mix 1 part of glacial acetic acid with 10 parts of water, add 1 part of yellow mercuric oxide and agitate until solution results. Then add 1.4 parts of sodium benzoate, dissolved in 10 parts of water, and collect, wash and dry the precipitate
Hydrargyri Bromidum, $HgBr_2$ Mercuric Bromide	By dissolving mercuric oxide in hot aqueous hydrobromic acid, filtering and concentrating, then crystallizing
Hydrargyri Carbonas, Hg_2CO_3 Mercurous Carbonate	By precipitating a solution of mercurous nitrate with acid potassium carbonate
Mercuric Cholate Mergal	A mixture of 1 part of mercuric cholate and 2 parts of albumin tannate
Hydrargyri Chloras, $Hg(ClO_3)_2$ Mercuric Chlorate	By dissolving mercuric oxide in warm chloric acid, filtering and concentrating, then crystallizing
Hydrargyri Chromas, $HgCrO_4$ Mercuric Chromate	By boiling equal parts of chromium trioxide and yellow mercuric oxide in water, and collecting crystals
Hydrargyri Cyanidum, $Hg(CN)_2$ Mercuric Cyanide	By passing hydrocyanic acid into a vessel containing mercuric oxide with water
Hydrargyri Lactas, $(Hg_2)_2(C_3H_5O_3)_2+2H_2O$ Mercurous Lactate	By mixing boiling solutions of sodium lactate and mercurous nitrate, and collecting the precipitate
Hydrargyri Oxycyanidum $Hg(CN)_2.HgO$ Mercuric Oxycyanide	Used as a germicide; more powerful than mercuric chloride and does not corrode steel instruments

Unofficial Salts of Mercury—*Continued*

Hydrargyri Nucleinas Mercury Nucleinate Mercurol	By adding a solution of mercuric chloride to an alkaline solution of nuclein
Hydrargyri Subsulphas Flavus, $Hg(HgO)_2SO_4$ Yellow Mercuric Subsulphate	By adding mercuric sulphate to boiling water
Hydrargyri Succinimidum Mercuric Succinimide	By dissolving freshly precipitated mercuric oxide in a warm aqueous solution of succinimide, evaporating and crystallizing
Hydrargyri Sulphidum Nigrum, HgS Black Mercuric Sulphide Ethiops Mineral	By rubbing together equal parts of mercury and sulphur
Hydrargyri Sulphidum Rubrum, HgS Red Mercuric Sulphide Vermilion	By fusing and subliming mercury and sulphur
Hydrargyri Nitras, $HgNO_3+H_2O$ Mercurous Nitrate	By mixing 4 parts mercury, 3 parts nitric acid, 1 part water, and after twenty-four hours collecting the crystals
Hydrargyri Sulphas, $HgSO_4$ Mercuric Sulphate	By heating 10 oz. mercury with 6 fl. oz. sulphuric acid, in a porcelain vessel, and stirring constantly until a white salt is obtained

HYDRARGYRUM. U. S. *Mercury*

[**Hydrarg.**—QUICKSILVER]

It contains not less than 99.5 per cent. of Hg (200.6). Preserve it in strong, well-closed containers.

Mercury for pharmaceutical uses should be pure. To separate mechanical impurities, moisture, or small quantities of oxide, mercury may be filtered by collecting it in a sound piece of chamois leather and, gathering the corners together, forcibly squeezing the particles through the pores of the leather. But distillation is preferable in most cases to purify the metal effectually, which may be accomplished by a process formerly official in the British Pharmacopœia, as follows:

Take of mercury, 3 pounds [avoirdupois]; hydrochloric acid, 3 fluidrachms; distilled water, a sufficiency. Place the mercury in a glass retort or iron bottle, and, applying heat, cause two pounds and a half of the metal to distil over into a flask employed as a receiver. Boil on this for five minutes the hydrochloric acid diluted with 9 fluidrachms of distilled water, and having, by repeated affusions of distilled water and decantations, removed every trace of acid, let the mercury be transferred to a porcelain capsule, and dried first by filter paper, and finally on a water bath.

Official Description.—It is a shining, silver-white metal; liquid at ordinary temperatures and easily divisible into spherical globules. When cooled to about −40° C. (−40° F.), it forms a ductile, malleable mass.

Odor and Taste.—It is without odor or taste.

Specific Gravity.—About 13.5 at 25° C. (77° F.).

Solubility.—Mercury is insoluble in the ordinary solvents, also in concentrated hydrochloric acid and, at ordinary temperatures, in sulphuric acid, but it dissolves in the latter when boiled with it, and is readily and completely dissolved by nitric acid.

Tests for Identity.—At ordinary temperatures Mercury volatilizes very slowly, but more rapidly as the temperature increases, and at about 358° C. (676.4° F.) it boils and is volatilized, yielding not more than 0.02 per cent. of residue.

Impurities and Tests for Impurities.—When globules of Mercury are dropped upon white paper, they roll about freely, retaining their globular form, and leaving no streaks or traces.

Mercury must be perfectly dry and present a bright surface even after agitation in contact with air.

Assay.—Dissolve about 0.4 Gm. of Mercury, accurately weighed, in a mixture of 10 mils of distilled water and 10 mils of nitric acid, warm the solution gently until red fumes cease to be evolved and the solution is colorless, and add 150 mils of distilled water. Then add 2 mils of ferric ammonium sulphate T.S. and titrate with tenth-normal potassium sulphocyanate V.S. to the production of a permanent, yellowish-red color. It shows not less than 99.5 per cent. of Hg. Each mil of tenth-normal potassium sulphocyanate V.S. used corresponds to 0.01003 Gm. of Hg. Each gramme of Mercury corresponds to not less than 99.2 mils of tenth-normal potassium sulphocyanate V.S.

Mercury may also be assayed by the Electrolytic method (see U. S. P., Test No. 4, Chapter LXII).

U. S. P. Preparations.—Hydrargyrum cum Creta; Massa Hydrargyri; Unguentum Hydrargyri; Unguentum Hydrargyri Dilutum (from Mercurial Ointment); Unguentum Hydrargyri Nitratis.

N. F. Preparation.—Petroxolinum Hydrargyri.

Uses.—When mercury is administered in a finely divided condition, as in blue mass, or in mercury with chalk, it exerts an action upon the liver, which is termed alterative. This action is possessed by some of its salts.

MASSA HYDRARGYRI. U. S. Mass of Mercury

[**Mass. Hydrarg.**—BLUE MASS BLUE PILL]

It contains not less than 32 per cent. nor more than 34 per cent. of Hg. Preserve the product in well-closed containers.

	Metric	Old form
***Mercury**	33 Gm.	5 oz. av. 122 gr.
Oleate of Mercury	1 Gm.	70 gr.
Glycyrrhiza, in No. 60 powder	10 Gm.	1 oz. av. 263 gr.
Althæa, in No. 60 powder	15 Gm.	2 oz. av. 175 gr.
Glycerin	9 Gm.	1 oz. av. 193 gr.
Honey of Rose	32 Gm.	5 oz. av. 52 gr.
To make	100 Gm.	16 oz. av.

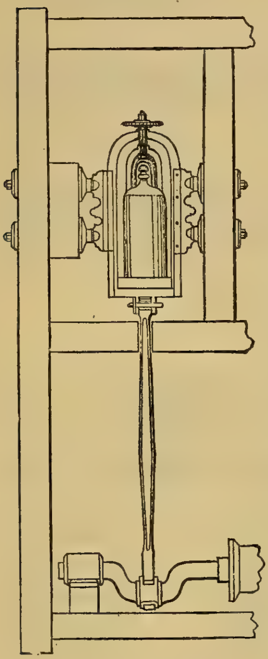
Triturate the oleate of mercury in a warm mortar, gradually add the mercury, then introduce a small amount of honey of rose and triturate the mixture until globules of mercury are no longer visible under a lens magnifying ten diameters. Now incorporate the remainder of the honey of rose and the glycerin, then gradually add the glycyrrhiza and althæa and continue the trituration until the mass is homogeneous.

Assay.—Place about 0.5 Gm. of Mass of Mercury, accurately weighed, in a porcelain dish, add 10 mils of sulphuric acid, heat on a water bath for ten minutes, then add 10 mils of nitric acid and heat the mixture on a sand bath, adding small portions of nitric acid, if necessary, until a colorless or nearly colorless solution results. Now add potassium permanganate T.S. to the hot solution until the red color persists, then discharge the color by the addition of just sufficient oxalic acid T.S. Wash the solution into a flask with distilled water, dissolve any insoluble residue by the addition of nitric acid, dilute the solution to about 150 mils, add 2 mils of ferric ammonium sulphate T.S. and titrate the solution with tenth-normal potassium sulphocyanate V.S. to the production of a pink tint. It shows not less than 32 per cent. nor more than 34 per cent. of Hg. Each mil of tenth-normal potassium sulphocyanate V.S. used corresponds to 0.01003 Gm. of Hg. Each gramme of Mass of Mercury corresponds to not less than 31.9 nor more than 33.9 mils of tenth-normal potassium sulphocyanate V.S.

N. F. Preparations.—Pilulæ ad Prandium (Cole's); Pilulæ Aloes, Hydrargyri et Podophylli; Pilulæ Aloes, Hydrargyri et Scammonii Compositæ; Pilulæ Antidyspepticæ; Pilulæ Digitalis, Scillæ et Hydrargyri.

By using the official formula the pharmacist is enabled to make blue mass extemporaneously with very little labor. The mass should not be *forcibly pressed,* or the globules of mercury will run together, and will grow larger instead of smaller.

Fig. 446



Squibb's mercurial shaker

Uses.—The object of this preparation is to furnish mercury in a finely divided condition. It is given in small doses to produce salivation, and in doses of three to ten grains (0.2 to 0.6 Gm.) as an alterative or purgative.

Fig. 446 illustrates the mercurial shaker invented by Dr. Squibb. It consists of a stout wooden frame to which is attached a metal cage for holding a strong glass gallon bottle; this is held in place by a cup-shaped screw clamp which rests on a cloth collar placed around the top of the bottle above the shoulder; the sides of the cage move in guides which are bolted to the wooden frame. A vertical shaft operated by the horizontal shaft at the bottom communicates an "up and down" motion to the bottle, and, when speeded properly, the mercury and a mixture containing honey in the bottle is thrown from the top to the bottom rapidly, and the mercury is thus quickly extinguished. The mixture is afterwards incorporated with the powders, placed in a large vessel and the mass is finished. In making mercurial ointment, the mercury is placed in the bottle holding the lard, and both are shaken together; the mixture is afterwards incorporated with the melted suet. This process of extinguishing mercury is termed "succussion."

HYDRARGYRUM CUM CRETA. U. S. **Mercury with Chalk**

[Hydrarg. c. Cret.—Gray Powder]

It contains not less than 37 per cent. nor more than 39 per cent. of Hg.

	Metric	Old form
***Mercury**	**38 Gm.**	166 grains
Clarified Honey	**10 Gm.**	44 grains
Prepared Chalk	**57 Gm.**	248 grains
Water, a sufficient quantity,		
To make	**100 Gm.**	1 oz. av.

Weigh the mercury and clarified honey successively into a strong bottle of the capacity of 100 mils [old form 1 fl. oz.] and add 2 mils [old form 10 minims] of water. Cork the bottle, and shake it for about half an hour at a time, until the aggregate time of shaking reaches ten hours, or until the globules of mercury are no longer visible under a lens magnifying *four diameters.* The shaking may be more conveniently performed by mechanical means. Rub the prepared chalk with water in a mortar to a thick, creamy paste, and, having added the contents of the bottle, wash out the last portions with a little water, and triturate the whole to a uniform mixture. Finally dry the mixture, first between ample layers of bibulous paper, and afterwards in a dish at the ordinary temperature, until it weighs 100 Gm. [old form 1 oz. av.]. Then reduce it to a uniform powder, without trituration, and keep it in well-closed containers, protected from light.

The intention here is to furnish mercury in a finely divided condition in the form of a powder. The above process is a very tedious one. In Matter's process, fifty-three grains of powdered acacia are mixed with fifty-three grains of chalk, enough water added to form a thin paste, and one hundred and sixty-six grains of mercury added and triturated until extinguished. One hundred and sixty-six grains of chalk are made into a paste with water, and added to it, and the water evaporated from the mixture in a water bath; it is rubbed to powder when dry.

Official Description.—It is a light gray, rather damp powder, free from grittiness.

Odor and Taste.—Without odor, and having a slightly sweet taste.

Impurities and Tests for Impurities.—*Mercurous Oxide.*—Digest 0.1 Gm. of the powder with 20 mils of warm acetic acid; the chalk dissolves with effervescence, and a residue of finely divided mercury is left. On filtering this mixture, the filtrate becomes not more than slightly opalescent on the addition of a few drops of hydrochloric acid.

Mercuric Oxide.—Digest 0.1 Gm. of the powder with 20 mils of warm diluted hydrochloric acid and filter; the filtrate is not rendered more than slightly brown by hydrogen sulphide T.S.

Assay.—Dissolve about 1 Gm. of Mercury with Chalk, accurately weighed, in a mixture of 10 mils of distilled water and 10 mils of nitric acid and heat it on a water bath until red fumes cease to be evolved and the liquid becomes colorless. Then add 150 mils of distilled water and 2 mils of ferric ammonium sulphate T.S. and titrate the solution with tenth-normal potassium sulphocyanate V.S. It shows not less than 37 per cent. nor more than 39 per cent. of Hg. Each mil of tenth-normal potassium sulphocyanate V.S. used corresponds to 0.01003 Gm. of Hg. Each gramme of Mercury with Chalk corresponds to not less than 36.9 mils nor more than 38.9 mils of tenth-normal potassium sulphocyanate V.S.

Mercury with Chalk may also be assayed by the Electrolytic method (see U. S. P., Test No. 4, Chapter LXII).

Uses.—Mercury with chalk is a mild mercurial, frequently given to children. It should be free from mercurous or mercuric oxide; through exposure to air old specimens frequently contain both. The dose is four to ten grains (0.25 to 0.6 Gm.).

HYDRARGYRUM AMMONIATUM. U. S. Ammoniated Mercury

[**Hydrarg. Ammon.**—White Precipitate]

It contains mercurammonium chloride [$HgNH_2Cl = 252.09$] corresponding to not less than 78 per cent. nor more than 80 per cent. of Hg. Preserve it in well-closed containers, protected from light.

Preparation.—The U. S. P. IX omitted the process for the manufacture, but the U. S. P. VIII process was as follows:

Dissolve 100 Gm. [old form 1 oz. av.] of corrosive mercuric chloride in 2000 mils [old form 20 fl. oz.] of warm distilled water, filter the solution, and allow it to cool. Pour the filtered liquid gradually, and with constant stirring, into 150 mils [old form 1½ fl. oz.] of ammonia water, taking care that the latter shall remain in slight excess. Collect the precipitate on a filter, and, when the liquid has drained from it as much as possible, wash it with a mixture of 400 mils [old form 4 fl. oz.] of distilled water and 20 mils [old form 1½ fl. dr.] of ammonia water. Finally, dry the precipitate between sheets of bibulous paper, in a dark place, at a temperature not exceeding 30° C. (86° F.), and keep it in well-stoppered bottles, protected from light.

In this process the ammonium of one-half of the ammonium chloride, which is formed upon mixing the solutions, has two of its hydrogen atoms replaced by one atom of bivalent mercury, NH_4Cl becoming NH_2HgCl.

$$\underset{\substack{\text{Mercuric}\\\text{Chloride}}}{HgCl_2} + \underset{\substack{\text{Ammonia}\\\text{Water}}}{2NH_4OH} = \underset{\substack{\text{Ammonium}\\\text{Chloride}}}{NH_4Cl} + \underset{\substack{\text{Mercurammonium}\\\text{Chloride}}}{NH_2HgCl} + \underset{\text{Water}}{2H_2O}$$

Official Description.—It occurs as white, pulverulent pieces, or as a white, amorphous powder; permanent in the air.

Odor and Taste.—Without odor, and having an earthy, afterwards styptic and metallic taste.

Solubility.—Ammoniated Mercury is insoluble in water or alcohol. By prolonged washing with water it is gradually decomposed, assuming a yellow color, and becoming converted into a basic salt. Readily dissolved by warm hydrochloric, nitric, or acetic acid, and by a cold solution of ammonium carbonate. Also completely dissolved by a cold solution of sodium thiosulphate, with the evolution of ammonia; when this solution is heated for a short time, red mercuric sulphide is separated, which on protracted boiling turns black.

Tests for Identity.—At a temperature below a red heat, Ammoniated Mercury is decomposed without fusion, and at a red heat it is volatilized without leaving more than 0.2 per cent. of residue.

When heated with potassium hydroxide T.S., the salt turns yellow, and evolves ammonia.

A solution of the salt in diluted nitric acid yields with potassium iodide T.S. a red precipitate soluble in an excess of the reagent. With silver nitrate T.S. its nitric acid solution yields a white precipitate.

Impurities and Tests for Impurities.—*Mercurous Salts.*—The salt is completely soluble in hydrochloric acid, and

Carbonates.—Without effervescence.

Assay.—Dissolve about 0.5 Gm. of Ammoniated Mercury, accurately weighed, in 2 mils of hydrochloric acid and 10 mils of distilled water, warming gently until solution is effected, then dilute with 300 mils of distilled water and proceed as directed under *Hydrargyi Chloridum Corrosivum*, page 919, beginning with the word "Pass" on line 3 of the Assay. The weight of mercuric sulphide obtained when multiplied by 0.862 indicates its equivalent in mercury (Hg), which corresponds to not less than 78 per cent. nor more than 80 per cent. of Hg. Each gramme of Ammoniated Mercury corresponds to not less than 0.9047 Gm. nor more than 0.9279 Gm. of mercuric sulphide.

Ammoniated Mercury may also be assayed by the Electrolytic method (see U. S. P., Test No. 4, Chapter LXII).

U. S. P. Preparation.—Unguentum Hydrargyri Ammoniati.

Uses.—This compound of mercury is not used internally; it is applied externally in the form of ointment chiefly in cutaneous affections, as psoriasis, eczema, and troubles of parasitic origin, as ringworm.

HYDRARGYRI CHLORIDUM CORROSIVUM. U. S. Corrosive Mercuric Chloride

[**Hydrarg. Chlor. Corr.**—BICHLORIDE OF MERCURY CORROSIVE SUBLIMATE MERCURIC CHLORIDE PERCHLORIDE OF MERCURY]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99.5 per cent. of $HgCl_2$ (271.52). Preserve it in well-closed containers.

Preparation.—This important mercuric salt may be made by the former official process, as follows:

Take of mercury, 24 oz.; sulphuric acid, 36 oz.; sodium chloride, 18 oz. Boil the mercury with the sulphuric acid, by means of a sand bath, until a dry, white mass remains. Rub this, when cold, with the sodium chloride in an earthenware mortar; then sublime the mixture with a gradually increasing heat.

By boiling sulphuric acid in excess with mercury to dryness, a white salt (mercuric sulphate) is formed, according to the reaction:

$$\underset{\substack{\text{Sulphuric}\\ \text{Acid}}}{2H_2SO_4} + \underset{\text{Mercury}}{Hg} = \underset{\substack{\text{Mercuric}\\ \text{Sulphate}}}{HgSO_4} + \underset{\substack{\text{Sulphur}\\ \text{Dioxide}}}{SO_2} + \underset{\text{Water}}{2H_2O}$$

When this is mixed with sodium chloride, and the mixture exposed to a subliming heat, decomposition takes place, according to the reaction:

$$\underset{\substack{\text{Mercuric}\\ \text{Sulphate}}}{HgSO_4} + \underset{\substack{\text{Sodium}\\ \text{Chloride}}}{2NaCl} = \underset{\substack{\text{Sodium}\\ \text{Sulphate}}}{Na_2SO_4} + \underset{\substack{\text{Mercuric}\\ \text{Chloride}}}{HgCl_2}$$

The mercuric chloride thus formed sublimes, and the sodium sulphate remains.

Official Description.—It occurs as heavy, colorless, rhombic crystals, or crystalline masses, or as a white powder.

Odor, Taste, and Reaction.—Odorless, permanent in the air, and having a characteristic and persistent metallic taste. *Great caution should be used in tasting it.* An aqueous solution of Corrosive Mercuric Chloride (1 in 20) is acid to litmus, but becomes neutral upon the addition of sodium chloride.

Solubility.—One Gm. of Corrosive Mercuric Chloride dissolves in 13.5 mils of water, 3.8 mils of alcohol, about 12 mils of glycerin, and in 22 mils of ether, at 25° C. (77° F.); also in 2.1 mils of boiling water and 1.6 mils of boiling alcohol.

Tests for Identity.—The salt fuses to a colorless liquid at 265° C. (509° F.) and at about 300° C. (572° F.) it volatilizes in dense white vapors, leaving not more than 0.1 per cent. of residue.

Separate portions of an aqueous solution of the salt (1 in 20) yield a white precipitate with ammonia water; a black precipitate with an excess of hydrogen sulphide; a red precipitate, soluble in an excess of the reagent, with potassium iodide T.S.; and a white precipitate, insoluble in nitric acid, with silver nitrate T.S.

Impurities and Tests for Impurities.—Not more than 0.5 per cent. of residue remains on dissolving finely powdered Corrosive Mercuric Chloride in ether or alcohol.

Assay.—Dissolve about 0.5 Gm. of Corrosive Mercuric Chloride, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed, in 300 mils of cold distilled water to which 1 mil of hydrochloric acid has been added. Pass hydrogen sulphide through the cold solution until saturated and the precipitate of mercuric sulphide readily subsides, leaving a clear, supernatant liquid. Collect the precipitate on counterpoised filters, wash it well with cold distilled water and finally with three portions of about 10 mils each of alcohol. Then close the tip of the funnel with a cork stopper, add sufficient carbon tetrachloride to cover the precipitate, cover the funnel with a watch-glass, and allow it to stand for about half an hour. Then drain off the solvent and wash the precipitate with further portions of carbon tetrachloride until after evaporating about 1 mil of the filtrate no visible residue remains. Remove the adhering carbon tetrachloride by washing with several portions of 10 mils each of alcohol and, after drying in the air, transfer to an oven and dry to constant weight at about 110° C. (230° F.). The weight of mercuric sulphide obtained, when multiplied by 1.167, indicates its equivalent in $HgCl_2$, which corresponds in the dried salt to not less than 99.5 per cent. of $HgCl_2$. Each gramme of Corrosive Mercuric Chloride, previously dried to constant weight, corresponds to 0.8526 Gm. of mercuric sulphide.

Corrosive Mercuric Chloride, previously dried to constant weight, may also be assayed by the Electrolytic method (see U. S. P., Test No. 4, Chapter LXII).

U. S. P. Preparation.—Toxitabellæ Hydrargyri Chloridi Corrosivi.

N. F. Preparations.—Lotio Flava; Mulla Hydrargyri Chloridi Corrosivi.

Uses.—Pharmaceutically, mercuric chloride is used in several preparations to furnish the mercury in the compounds. Medicinally, as an alterative, it is one of the most valuable internal remedies in syphilis and chronic rheumatism, the dose being one-twentieth of a grain (0.003 Gm.). Externally, it is used as a stimulant and escharotic. Recently it has been very extensively employed in antiseptic surgery. For this purpose it is usually sold in the form of tablets, mixed with sodium chloride, which renders it more readily soluble. These tablets have been so commonly sold and so often mistaken for headache tablets, with fatal results, that the laws of many States and the Pharmacopœia have established rigid regulations for their appearance so as to render them distinctive and readily recognized as poisonous. See *Toxitabellæ Hydrargyri Chloridi Corrosivi* (Chapter LXVII). It is a powerful antiseptic, but great care is required on account of its poisonous properties. The antidote to poisoning by corrosive sublimate is the free use of white of egg, milk, or other albuminous liquids, followed by an emetic.

HYDRARGYRI CHLORIDUM MITE. U. S. Mild Mercurous Chloride

[**Hydrarg. Chlor. Mit.**—Mercurous Chloride Calomel Protochloride of Mercury Subchloride of Mercury]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99.6 per cent. of HgCl (236.06). Preserve it in well-closed containers, protected from light.

Preparation.—The former official process may be used to prepare mercurous chloride, as follows:

Take of mercury, 48 oz.; sulphuric acid, 36 oz.; sodium chloride, 18 oz.; distilled water, a sufficient quantity. Boil, by means of a sand bath, 24 oz. of the mercury with the sulphuric acid, until a dry, white mass remains. Rub this, when cold, with the remainder of the mercury, in an earthenware mortar, until they are thoroughly mixed. Then add the sodium chloride, and, having rubbed it with the other ingredients until globules of mercury cease to be visible, sublime the mixture into a large chamber so that the sublimate may fall in powder. Wash the sublimed matter with boiling distilled water until the washings afford no precipitate with ammonia water, and dry it.

In this preparation mercuric sulphate is first made; this is then triturated with a quantity of mercury equal to that used in forming it; mercurous sulphate is produced, and when this is mixed with sodium chloride and sublimed, mercurous chloride is produced as a fine white sublimate, and sodium sulphate remains behind.

$$\underset{\text{Sulphuric Acid}}{2H_2SO_4} + \underset{\text{Mercury}}{Hg} = \underset{\text{Mercuric Sulphate}}{HgSO_4} + \underset{\text{Sulphur Dioxide}}{SO_2} + \underset{\text{Water}}{2H_2O}$$

$$\underset{\text{Mercuric Sulphate}}{HgSO_4} + \underset{\text{Mercury}}{Hg} = \underset{\text{Mercurous Sulphate}}{Hg_2SO_4}$$

$$\underset{\text{Mercurous Sulphate}}{Hg_2SO_4} + \underset{\text{Sodium Chloride}}{2NaCl} = \underset{\text{Mercurous Chloride}}{2HgCl} + \underset{\text{Sodium Sulphate}}{Na_2SO_4}$$

Official Description.—It is a white, impalpable powder, becoming yellowish-white on being triturated with strong pressure, and showing only small, isolated crystals when viewed under a lens having a magnifying power of one hundred diameters; permanent in the air.

Odor and Taste.—It is odorless and tasteless.

Solubility.—Mild Mercurous Chloride is insoluble in water, alcohol, ether or cold dilute acids.

Tests for Identity.—When strongly heated, Mild Mercurous Chloride is volatilized without fusion or the evolution of brown vapors, leaving not more than 0.1 per cent. of residue.

The salt is blackened by contact with calcium hydroxide T.S., with solutions of alkali hydroxides or with ammonia water.

When heated with an equal weight of dried sodium carbonate (free from chloride) in a dry glass tube, Mild Mercurous Chloride yields a sublimate of metallic mercury. Dissolve the residue in nitric acid and filter; silver nitrate T.S. produces in the filtrate a white, curdy precipitate insoluble in nitric acid.

Impurities and Tests for Impurities.—*Mercuric Chloride.*—Shake 2 Gm. of the salt with 20 mils of ether, filter, evaporate the filtrate, and add 10 mils of distilled water; not more than a slight opalescence results upon the addition of silver nitrate T.S. to 5 mils of the solution.

Ammoniated Mercury.—Heat 1 Gm. of the salt with potassium hydroxide T.S.; no ammonia is evolved.

Assay.—Mix, in a tared flask, about 1 Gm. of Mild Mercurous Chloride, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed, with 10 mils of distilled water, add 50 mils of tenth-normal iodine V.S. and 5 Gm. of potassium iodide, dissolved in 10 mils of distilled water, stopper the flask, allow the mixture to stand, with occasional agitation, until complete solution has taken place and estimate the excess of iodine by titration with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator. It shows, in the dried salt, not less than 99.6 per cent. of $HgCl$. Each mil of tenth-normal iodine V.S. used corresponds to 0.023606 Gm. of $HgCl$. Each gramme of Mild Mercurous Chloride, previously dried to constant weight, corresponds to not less than 42.2 mils of tenth-normal iodine V.S.

Mild Mercurous Chloride, previously dried to constant weight, may also be assayed by the Electrolytic method (see U. S. P., Test No. 4, Chapter LXII).

U. S. P. Preparation.—Pilulæ Catharticæ Compositæ.

N. F. Preparations.—Lotio Nigra; Pilulæ Antimonii Compositæ; Pulvis Hydrargyri Chloridi Mitis et Jalapæ; Trochisci Santonini Compositi.

Uses.—Calomel is largely used as an hepatic stimulant and alterative; it is also purgative, and, in large doses, sedative. It is given in doses of one-quarter to one-half grain (0.015 to 0.03 Gm.) as an alterative and two to five grains (0.13 to 0.3 Gm.) as a laxative. Care must be exercised in prescribing calomel with other remedies that the chemical action does not produce corrosive sublimate.

HYDRARGYRI IODIDUM FLAVUM. U. S. Yellow Mercurous Iodide

[**Hydrarg. Iod. Flav.**—MERCUROUS IODIDE PROTOIODIDE OF MERCURY
YELLOW IODIDE OF MERCURY]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99 per cent. of HgI (327.52). Preserve it in well-closed containers, protected from light.

Preparation.—The details for its manufacture were omitted from the U. S. P. IX, but the U. S. P. VIII process is as follows:

Mix 20 mils [old form 5 fl. dr.] each, of nitric acid and distilled water, and, when the liquid is cold, pour it upon 50 Gm. [old form 1 oz. av. 293 gr.] of mercury contained in a glass beaker. Set the mixture aside in a dark place, and keep it at a temperature between 25° and 30° C. (77° and 86° F.), with occasional agitation, until the reaction ceases and a little mercury still remains undissolved. Separate the crystals of mercurous nitrate, which will have formed, from the mother liquor, allow them to drain in a glass funnel, and dry them on bibulous paper, in a dark place. When the salt is dry, dissolve 40 Gm. [old form 584 grains] of it in 650 mils [old form 20½ fl. oz.] of distilled water to which 6 mils [old form 92 minims] of nit ic acid have previously been added. Having prepared a solution of 16 Gm. [old form 233 grains] of potassium iodide in 32 mils [old form 1 fl. oz.] of distilled water, slowly pour the solution of potassium iodide into the solution of mercurous nitrate, with constant stirring, which should be continued for fifteen minutes, allow the precipitate to subside, decant the supernatant liquid, and wash the precipitate by decantation with ten successive portions of 500 mils [old form 1 pint] each of distilled water. Finally, transfer the precipitate to a filter, and dry it between sheets of bibulous paper, in a dark place, at a temperature not exceeding 40° C. (104° F.), and keep it in dark amber-colored vials, with the least possible exposure to light.

Instead of weighing off 40 Gm. [old form 584 grains] of the mercurous nitrate as above directed, the whole of the crystallized salt may be taken and the amount of potassium iodide, etc., adjusted to the proportions given above.

Official Description.—It is a bright yellow, amorphous powder. By exposure to light it becomes greenish in proportion as it undergoes decomposition into metallic mercury and mercuric iodide.

Odor and Taste.—Odorless and tasteless.

Solubility.—Yellow Mercurous Iodide is almost insoluble in water and wholly insoluble in alcohol or ether.

Tests for Identity.—When slowly and moderately heated, it assumes at first an orange and then a red color, becoming yellow again on cooling. When quickly and strongly heated, it is at first partially decomposed into mercury and mercuric iodide, and finally is volatilized, leaving not more than 0.2 per cent. of residue. When heated with an equal weight of dried sodium carbonate, in a dry glass tube, Yellow Mercurous Iodide yields a sublimate of metallic mercury.

When Yellow Mercurous Iodide is heated with sulphuric acid and a little manganese dioxide, the vapor of iodine is evolved.

Impurities and Tests for Impurities.—*Mercuric Iodide.*—When 0.5 Gm. of the salt is thoroughly shaken with 10 mils of alcohol and the mixture filtered, 5 mils of the perfectly clear filtrate is not affected by an equal volume of hydrogen sulphide T.S.

Assay.—Transfer to a flask about 1 Gm. of Yellow Mercurous Iodide, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed, add 50 mils of tenth-normal iodine V.S. and 5 Gm. of potassium iodide, dissolved in 10 mils of distilled water, stopper the flask, and allow the mixture to stand in the tightly stoppered flask, with occasional agitation, until complete solution has taken place. Then titrate with tenth-normal sodium thiosulphate V.S., using starch T.S. as indicator. It shows, in the dried salt, not less than 99 per cent. of HgI. Each mil of tenth-normal iodine V.S. used corresponds to 0.032752 Gm. of HgI. Each gramme of Yellow Mercurous Iodide, previously dried to constant weight, corresponds to not less than 30.2 mils of tenth-normal iodine V.S.

Yellow Mercurous Iodide, previously dried to constant weight, may also be assayed by the Electrolytic method (see U. S. P., Test No. 4, Chapter LXII).

Uses.—Yellow mercurous iodide is used as an alterative. It is better adapted for internal administration than the red iodide, because it is milder. The dose is from one-sixth to one grain (0.01 to 0.065 Gm.).

HYDRARGYRI IODIDUM RUBRUM. U. S. Red Mercuric Iodide

[**Hydrarg. Iod. Rub.**—Biniodide of Mercury Mercuric Iodide Red Iodide of Mercury]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99 per cent. of HgI_2 (454.44). Preserve it in well-closed containers, protected from light.

Preparation.—The U. S. P. IX omitted the manufacturing details, but the U. S. P. VIII process was as follows:

	Metric	Old Form
Corrosive Mercuric Chloride	**40 Gm.**	1 oz. av. 148 gr.
Potassium Iodide	**50 Gm.**	1 oz. av. 293 gr.
Distilled Water, a sufficient quantity.		

Dissolve 40 Gm. [old form 1 oz. av. 148 gr.] of corrosive mercuric chloride and 50 Gm. [old form 1 oz. av. 293 gr.] of potassium iodide, each, in 800 mils [old form 25½ fl. oz.] of distilled water, and filter the solutions separately. Pour both solutions, simultaneously and in a thin stream, with constant and very active stirring, into 2000 mils [old form 4 pints] of distilled water. When the precipitate has subsided, decant the supernatant liquid, collect the precipitate on a filter, and wash it with cold distilled water, until the washings give not more than a slight opalescence with silver nitrate test solution. Finally, dry it, in a dark place, between sheets of bibulous paper, at a temperature not exceeding 40° C. (104° F.), and keep it in well-stoppered bottles, protected from light.

In this process mercuric iodide and potassium chloride are formed by double decomposition.

$$\underset{\text{Mercuric Chloride}}{HgCl_2} + \underset{\text{Potassium Iodide}}{2KI} = \underset{\text{Mercuric Iodide}}{HgI_2} + \underset{\text{Potassium Chloride}}{2KCl}$$

As mercuric iodide is soluble in solutions both of mercuric chloride and of potassium iodide, it is not profitable to use an excess of either. It may be obtained in handsome crystals by dissolving it in hot hydrochloric acid to saturation and allowing the solution to cool slowly.

Official Description.—It is a scarlet-red, amorphous powder; permanent in the air.

Odor and Taste.—Odorless, nearly tasteless.

Solubility.—Red Mercuric Iodide is almost insoluble in water; 1 Gm. dissolves in 115 mils of alcohol, 910 mils of chloroform, and in 120 mils of ether at 25° C. (77° F.); also in 20 mils of boiling alcohol; soluble in solutions of the soluble iodides, mercuric chloride, sodium thiosulphate, and hot solutions of the alkali chlorides.

Tests for Identity.—When heated to about 150° C. (302° F.), the salt becomes yellow, but again assumes a red color on cooling; upon further heating, it fuses to a dark yellow liquid which, on cooling, forms a yellow, crystalline mass; at higher temperatures it is finally volatilized, leaving not more than 0.2 per cent. of residue.

Heat the salt with potassium hydroxide T.S., and add a little sugar of milk; the compound is reduced and metallic mercury is precipitated.

Boil about 0.1 Gm. of the salt with 2 mils of potassium hydroxide T.S., filter and supersaturate the filtrate with nitric acid. The liquid becomes yellow from the liberation of iodine, which produces a blue color upon the addition of a few drops of starch T.S.

Impurities and Tests for Impurities.—*Soluble Mercury Salts.*—Agitate thoroughly about 0.5 Gm. of Red Mercuric Iodide with 10 mils of distilled water and filter; the filtrate does not become more than slightly colored by hydrogen sulphide T.S.

Two Gm. of Red Mercuric Iodide dissolves quickly in 100 mils of distilled water, containing 2 Gm. of potassium iodide, without leaving more than 0.004 Gm. of insoluble matter.

Assay.—Red Mercuric Iodide, when previously dried to constant weight in a desiccator over sulphuric acid and assayed by the Electrolytic method (see U. S. P., Test No. 4, Chapter LXII), shows not less than 99 per cent. of HgI_2.

U. S. P. Preparation.—Liquor Arseni et Hydrargyri Iodidi.
N. F. Preparation.—Liquor Hydrargyri et Potassii Iodidi.

Uses.—This iodide is used internally in the treatment of syphilis, in doses of one-twentieth of a grain (0.003 Gm.); it is frequently given in pill form combined with potassium iodide. Externally, it is often used in the form of an ointment, of the strength of sixteen grains in an ounce of simple ointment.

HYDRARGYRI OXIDUM FLAVUM. U. S. Yellow Mercuric Oxide

[Hydrarg. Oxid. Flav.]

It contains, when dried to constant weight at 150° C. (302° F.), not less than 99.5 per cent. of HgO (216.60). Preserve it in well-closed containers, protected from light.

Preparation.—The details for manufacturing this salt were omitted from the U. S. P. IX; the U. S. P. VIII process was as follows:

Dissolve 100 Gm. [old form 3 oz. av. 148 gr.] of corrosive mercuric chloride in 1000 mils [old form 2 pints] of warm distilled water, and filter the solution. Dissolve 40 Gm. [old form 1 oz. av. 147 gr.] of sodium hydroxide (which should contain at least 90 per cent. of pure, anhydrous sodium hydroxide) in 1000 mils [old form 2 pints] of cold distilled water, and into this solution pour gradually, and with constant stirring, the solution of corrosive mercuric chloride. Allow the mixture to stand for an hour at a temperature of about 30° C. (86° F.), stirring frequently. Then decant the supernatant, clear liquid from the precipitate, and wash the latter repeatedly by the addition and decantation of portions of distilled water, using 1000 mils [old form 2 pints] of water each time. Collect the precipitate on a strainer, and continue the washing with warm distilled water, until a small portion of the washings, when poured on a little mercuric chloride test solution, no longer produces a yellowish turbidity at the line of contact of the two liquids. Then allow the precipitate to drain, and dry it between sheets of bibulous paper, in a dark place, at a temperature not exceeding 30° C. (86° F.), and keep it in well-stoppered bottles, protected from light.

$$\underset{\text{Mercuric Chloride}}{HgCl_2} + \underset{\text{Sodium Hydroxide}}{2NaOH} = \underset{\text{Mercuric Oxide}}{HgO} + \underset{\text{Sodium Chloride}}{2NaCl} + \underset{\text{Water}}{H_2O}$$

Official Description.—It is a light orange-yellow, amorphous, heavy, impalpable powder; permanent in the air, but turning darker on exposure to light.

Odor, Taste, and Reaction.—Odorless, and having a somewhat metallic taste. When moistened with hot distilled water, Yellow Mercuric Oxide is not alkaline to litmus.

Solubility.—Yellow Mercuric Oxide is almost insoluble in water; insoluble in alcohol; readily dissolved by diluted hydrochloric or nitric acid, forming colorless solutions.

Tests for Identity.—When moderately heated, Yellow Mercuric Oxide assumes a red color.

Impurities and Tests for Impurities.—At a red heat it is completely decomposed into oxygen and metallic mercury, and is finally volatilized, leaving not more than 0.2 per cent. of residue.

A solution of 0.5 Gm. of Yellow Mercuric Oxide in 25 mils of either diluted hydrochloric or diluted nitric acid is not more than slightly turbid.

Distinction from Red Mercuric Oxide.—Heat 0.5 Gm. of Yellow Mercuric Oxide for two hours in a test tube, on a water bath, with a solution of 1 Gm. of oxalic acid in 10 mils of distilled water and 1 mil of ammonia water, replacing from time to time the water lost by evaporation; it is converted into white or yellowish-white mercuric oxalate.

Assay.—Dissolve about 0.5 Gm. of Yellow Mercuric Oxide, previously dried to constant weight at 150° C. (302° F.) and accurately weighed, in 10 mils of distilled water and 5 mils of nitric acid, and further dilute the solution with 150 mils of distilled water. Then add 2 mils of ferric ammonium sulphate T.S., and titrate with tenth-normal potassium sulphocyanate V.S. to the production of a permanent yellowish-red color. It shows, in the dried Oxide, not less than 99.5 per cent. of HgO. Each mil of tenth-normal potassium sulphocyanate V.S. used corresponds to 0.01083 Gm. of HgO. Each gramme of Yellow Mercuric Oxide, previously dried to constant weight, corresponds to not less than 91.9 mils of tenth-normal potassium sulphocyanate V.S.

Yellow Mercuric Oxide, previously dried to constant weight, may also be assayed by the Electrolytic method (see U. S. P., Test No. 4, Chapter LXII).

U. S. P. Preparations.—Oleatum Hydrargyri; Unguentum Hydrargyri Oxidi Flavi.

Uses.—Yellow mercuric oxide is used in making the oleate of mercury (see page 437) and in the official ointment (see Chapter LXVII); it is employed only externally.

HYDRARGYRI OXIDUM RUBRUM. U. S. Red Mercuric Oxide

[**Hydrarg. Oxid. Rub.**—RED PRECIPITATE]

It contains, when dried to constant weight at 150° C. (302° F.), not less than 99.5 per cent. of HgO (216.60). Preserve it in well-closed containers, protected from light.

Preparation.—This oxide may be made by a former official process, as follows:

Take of mercury, 36 oz.; nitric acid, 24 oz.; water, 2 pints. Dissolve the mercury, with the aid of a gentle heat, in the acid and water previously mixed, and evaporate to dryness. Rub the dry mass into powder, and heat it in a very shallow vessel until red vapors cease to rise.

Mercuric nitrate is first formed, and this is decomposed by heat.

$$\underset{\text{Mercuric Nitrate}}{2Hg(NO_3)_2} = \underset{\text{Mercuric Oxide}}{2HgO} + \underset{\text{Nitrogen Dioxide}}{4NO_2} + \underset{\text{Oxygen}}{O_2}$$

Official Description.—It occurs as heavy, orange-red, crystalline scales, or as a crystalline powder, acquiring a yellow color when finely divided; permanent in the air.

Odor, Taste, and Reaction.—Odorless and having a somewhat metallic taste.

Solubility.—Red Mercuric Oxide is almost insoluble in water; insoluble in alcohol; readily dissolved by diluted nitric acid, or by hydrochloric acid.

Tests for Identity.—When heated to about 400° C. (752° F.) Red Mercuric Oxide becomes dark-violet or almost black, but assumes its original color on cooling.

Impurities and Tests for Impurities.—At a red heat it is completely decomposed into oxygen and metallic mercury, and is finally volatilized without leaving more than 0.2 per cent. of residue.

A solution of 0.5 Gm. of Red Mercuric Oxide in 25 mils of either hydrochloric or nitric acid is not more than slightly turbid.

Distinction from Yellow Mercuric Oxide.—Heat 0.5 Gm. of Red Mercuric Oxide for two hours, in a test tube on a water bath, with a solution of 1 Gm. of oxalic acid in 10 mils of distilled water and 1 mil of ammonia water, replacing, from time to time, the water lost by evaporation; it will not change color within two hours.

Nitrate.—Mix 1 Gm. of Red Mercuric Oxide with 5 mils of distilled water, add 2 mils of sulphuric acid, cool the mixture and carefully pour upon it 2 mils of ferrous sulphate T.S.; no brown zone develops at the line of contact.

Assay.—Dissolve about 0.5 Gm. of Red Mercuric Oxide, previously dried to constant weight at 150° C. (302° F.) and accurately weighed, in 10 mils of distilled water and 5 mils of nitric acid, and further dilute the solution with 150 mils of distilled water. Then add 2 mils of ferric ammonium sulphate T.S., and titrate with tenth-normal potassium sulphocyanate V.S. to the production of a permanent yellowish-red color. It shows, in the dried Oxide, not less than 99.5 per cent. of HgO. Each mil of tenth-normal potassium sulphocyanate V.S. used corresponds to 0.01083 Gm. of HgO. Each gramme of Red Mercuric Oxide, previously dried to constant weight, corresponds to not less than 91.9 mils of tenth-normal potassium sulphocyanate V.S.

Red Mercuric Oxide, previously dried to constant weight, may also be assayed by the Electrolytic method (see U. S. P., Test No. 4, Chapter LXII).

N. F. Preparations.—Unguentum Hydrargyri Oxidi Rubri; Liquor Hydrargyri Nitratis.

Uses.—Red mercuric oxide has the same chemical composition as the yellow oxide. It is used in the form of ointment for inflamed eyelids, in skin diseases, and for destroying body vermin. This ointment is now official in the N. F. (see Chapter LXVII), having been omitted from the U. S. P. IX because of the difficulty of rubbing down the crystalline powder to a smooth ointment. In fact, when reduced to a proper degree of fineness, it corresponds to the yellow oxide, so that the Pharmacopœia has adopted the yellow oxide for the preparation of the ointment and the use of the red oxide should be discouraged.

HYDRARGYRI SALICYLAS. U. S. Mercuric Salicylate

[**Hydrarg. Salicyl.**—MERCURIC SUBSALICYLATE]

A compound of mercury and salicylic acid containing not less than 54 per cent. nor more than 59.5 per cent. of Hg. Preserve it in well-closed containers protected from light.

Preparation.—The formula for this salt is indefinite, but has been given as $Hg.C_6H_4O.CO_2$. It may be prepared as follows:

Dissolve 27 parts of corrosive mercuric chloride in 600 parts of distilled water, and filter. Dissolve 10.8 parts of sodium hydroxide in 600 parts of cold distilled water, and pour the corrosive sublimate solution into this with constant stirring. Allow it to stand for an hour, with frequent stirring, at a temperature of about 30° C. (86° F.) and then wash the precipitated mercuric oxide. Now digest this freshly precipitated oxide with a little water and 15 parts of salicylic acid at a boiling temperature until the mixture becomes white; collect the mercuric salicylate on a filter, wash until the filtrate is no longer acid and dry at a temperature between 30° and 40° C. (86° and 104° F.) and finally at 100° C. (212° F.).

Official Description.—It is a white, slightly yellowish or slightly pinkish powder.

Odor, Taste, and Reaction.—Odorless and tasteless.

Solubility.—Mercuric Salicylate is nearly insoluble in water or alcohol; dissolved by solutions of the fixed alkalies or their carbonates; dissolved by warm solutions of the alkali halides with the formation of double salts.

Tests for Identity.—Heat about 1 Gm. of the salt with 10 mils of hydrochloric acid; a solution is obtained from which salicylic acid separates on cooling. A piece of copper foil added to a portion of the filtered solution, nearly neutralized with ammonia water, immediately becomes coated with metallic mercury. To another portion of this solution add a few drops of ferric chloride T.S.; a violet color is produced.

Incinerate about 0.5 Gm. of the salt in a porcelain crucible; not more than 0.2 per cent. of residue remains.

Impurities and Tests for Impurities,—*Free Salicylic Acid.*—The salt does not redden moistened blue litmus paper.

Foreign Mercury Compounds.—No dark color results at once on shaking about 0.1 Gm. of the salt with 5 mils of hydrogen sulphide T.S.

About 0.2 Gm. of the salt dissolves completely in 4 mils of normal sodium hydroxide V.S.

Assay.—Digest about 0.5 Gm. of Mercuric Salicylate, accurately weighed, in 15 mils of sulphuric acid and 10 mils of nitric acid on a water bath until dissolved. Cool the solution, dilute it with 150 mils of distilled water, add 30 mils of solution of hydrogen dioxide and mix well. Now add gradually, with constant stirring, 5 mils of diluted hypophosphorous acid, then 5 Gm. of sodium chloride, dissolved in 20 mils of distilled water, stir thoroughly and allow the mixture to stand until the precipitate has subsided. Filter and wash the precipitate with distilled water. Transfer the precipitate and filter to a flask, add 50 mils of tenth-normal iodine V.S. and 2 Gm. of potassium iodide, agitate the mixture until all of the precipitate has dissolved and titrate the excess of tenth-normal iodine V.S. with tenth-normal sodium thiosulphate V.S. It shows not less than 54 per cent. nor more than 59.5 per cent. of Hg. Each mil of tenth-normal iodine V.S. corresponds to 0.02006 Gm. of Hg. Each Gm. of Mercuric Salicylate corresponds to not less than 26.9 mils nor more than 29.7 mils of tenth-normal iodine V.S.

Mercuric Salicylate may also be assayed by the Electrolytic method (see U. S. P., Test No. 4, Chapter LXII).

Uses.—It is used in doses of from one-twentieth to one-eighth grain (0.003 to 0.008 Gm.), usually hypodermically, suspended (1 in 10) in liquid petrolatum or oils. Wollheim recommends the following formula for its suspension for hypodermic injection: 2 Gm. of quinine and urea hydrochloride, 2 mils of distilled water, 12 Gm. of anhydrous wool fat, 10 Gm. of mercuric salicylate and sufficient olive oil or liquid petrolatum to make 100 mils. The mixture should be sterilized before use. It is used as an antiseptic and antisyphilitic.

As an antiseptic wash, similar in its use to mercuric chloride, the following formula has been suggested to render it soluble: 1 part of corrosive mercuric chloride, 3 parts of sodium salicylate, 100 parts of distilled water.

LIQUOR HYDRARGYRI ET POTASSII IODIDI. N. F. Solution of Mercury and Potassium Iodide

[**Liq. Hydrarg. et Pot. Iod.**—SOLUTION OF POTASSIUM IODOHYDRARGYRATE CHANNING'S SOLUTION]

	Metric	Old Form
Red Mercuric Iodide	**2.5 Gm.**	146 grains
Potassium Iodide	**2.0 Gm.**	117 grains
Distilled Water, a sufficient quantity,		
To make	**250 mils**	2 pints

Triturate the mercuric iodide and potassium iodide with about 5 mils [old form 307 minims] of distilled water until solution has been effected, then add sufficient distilled water to make the product measure 250 mils [old form 2 pints].

Uses.—It is used as an alterative and antisyphilitic in doses of three minims (0.2 mil).

LIQUOR HYDRARGYRI NITRATIS. N. F. Solution of Mercuric Nitrate

(U.S.P. VIII)

[**Liq. Hydrarg. Nit.**]

An aqueous solution containing not less than 58 per cent. nor more than 62 per cent. of anhydrous mercuric nitrate [$Hg(NO_3)_2 = 324.62$] and about 11 per cent. of free nitric acid.

	Metric	Old form
Red Mercuric Oxide	**40 Gm.**	6 oz. av. 425 gr.
Nitric Acid	**45 Gm.**	5 fl. oz. 160 min.
Distilled Water	**15 Gm**	2 fl. oz. 239 min.
To make	**100 Gm.**	8 fl. oz.

Mix the nitric acid with the distilled water, and dissolve the red mercuric oxide in the mixture. Keep the product in glass-stoppered bottles.

Official Description.—It is a clear, nearly colorless, heavy liquid.

Odor and Reaction.—Having a faint odor of nitric acid, and a strongly acid reaction.

Specific Gravity.—About 2.086 at 25°C. (77° F.).

Impurities and Tests for Impurities.—*Mercurous Salt.*—No precipitation or cloudiness occurs in the Solution on the addition of distilled water, or of diluted hydrochloric acid.

Assay.—Transfer about 1 Gm. of Solution of Mercuric Nitrate, accurately weighed in a tared and stoppered weighing-bottle, to a flask with the aid of about 150 mils of distilled water, add 2 mils of ferric ammonium sulphate T.S. and titrate with tenth-normal potassium sulphocyanate V.S. to the production of a permanent red color. It shows not less than 58 per cent. nor more than 62 per cent. of anhydrous mercuric nitrate. Each mil of tenth-normal potassium sulphocyanate V.S. used corresponds to 0.016231 Gm. of anhydrous mercuric nitrate [$Hg(NO_3)_2$]. Each gramme of Solution of Mercuric Nitrate corresponds to not less than 35.734 mils nor more than 38.198 mils of tenth-normal potassium sulphocyanate V.S.

Uses.—This is a corrosive liquid, used principally to cauterize malignant ulcerations, cancers, etc. It is never given internally.

QUESTIONS ON NICKEL, COBALT, TIN, LEAD, COPPER, SILVER, AND MERCURY

Nickel—What is the Latin name? Give symbol and atomic weight. (See page 898.)
Give description and specific gravity. Where is it obtained?
What alloy does it form with copper?
For what purpose are the salts of nickel used?
What are the tests for compounds of nickel?
Cobalt—Give symbol and atomic weight. Give description and specific gravity.
How is it found? What classes of salts does it form?
What is flystone, and how is it used?
What is barometer paper, and what is the explanation of its use?
What color does cobalt give to glass?
Are any of the salts of cobalt official?
What are the tests for salts of cobalt?
Tin—Give symbol and atomic weight.
Give description and specific gravity.
What classes of salts does it form?
What are the tests for compounds of tin?
Lead—Give Latin name, symbol and atomic weight. (See page 900.)
Give description and specific gravity.
How is it obtained?
What compounds does it form with oxygen?
What are the tests for compounds of lead?
Is water rendered poisonous by passing through lead pipes?
Lead acetate—Give Latin name, formula in symbols, and synonym.
How is it made?
Is the commercial salt fit for pharmaceutical use? Why?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Carbonate; iron and copper.
For what is it used medicinally? Why are its aqueous solutions usually turbid?
What is the dose?
Solution of lead subacetate—How much lead subacetate does this solution contain?
How is it prepared and what is the object of the process? By what other method may it be prepared?
What is its specific gravity? Describe appearance, odor, taste, and chemical reaction.

How may its strength be tested?
What is its popular name?
What are its properties and uses in medicine?
Diluted solution of lead subacetate—What is its synonym? Why is this solution usually opalescent?
Is turbidity an advantage or a disadvantage? Why?
For what is it used?
Lead oxide—Give Latin official name, and formula in symbols.
By what synonym is it commonly known?
How is the commercial salt usually obtained?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
What impurities are likely to be present and how may they be detected?
Lead carbonate—What is its Latin title, chemical formula, and synonym?
How is it prepared?
Describe appearance, odor, taste, solubility, and tests for identity.
Lead iodide—Give the Latin title and chemical formula.
How may it be prepared?
Describe its appearance, odor, taste, solubility, and tests for identity.
What impurities are likely to be present and how may they be detected?
How is it used medicinally?
Red oxide of lead—What is its Latin title, synonym, and chemical formula?
How may it be prepared?
Describe its appearance, odor, taste, solubility, and tests for identity.
What impurities are likely to be present and how detected?
What are its uses?
Copper—Give Latin name.
What is its symbol? What is its atomic weight? Give description and specific gravity.
How is it found?
What oxides does it form? Give their formulas.
What are the tests for compounds of copper?
Copper sulphate—Give formula in symbols and synonym.
How is it made?
How much water of crystallization does it contain?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may other metals be detected?
What are its uses and the dose? What is its commercial name?
Silver—Give Latin name, symbol, and atomic weight. Give description an specific gravity.
How is it found?
What combination does it make with oxygen?
What are the tests for silver salts?
Silver nitrate—Give formula in symbols and molecular weight.
How may it be made?
How is the copper separated from the silver, with which is it usually mixed, in making this solution?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may an impurity of copper be detected?
Describe the assay.
For what is it used medicinally?
What is the dose?
Moulded silver nitrate—What is the Latin official title? What synonyms are commonly used? How is it prepared?
What is the object of adding hydrochloric acid?
How may it be prevented from becoming discolored during the process of casting?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may its quality be tested?
For what is it used?
How may a convenient caustic-holder be made?
Silver oxide—Give Latin name and formula in symbols.
Describe the process (formerly official) by which it may be made.

Describe appearance, odor, taste, chemical reaction, and solubility.
How may impurity of chloride be detected?
What is its use? Why should it not be triturated with oxidizable or combustible substances?
What action does ammonia have upon it?
Mercury—Give Latin name, symbol, and atomic weight.
Describe it and give specific gravity.
How is it found, and where does it come from?
At what temperature does it solidify?
What two series of compounds does it form?
Is it used in medicine in the metallic state?
What are the tests or compounds of mercury?
How may mercury be purified?
Describe appearance, odor, taste, and chemical reaction.
What simple tests are applied officially to indicate its purity?
For what is it used medicinally?
Mass of mercury—Give the Latin name and synonyms.
How is it made?
What is the object of this preparation? What is the dose?
How may it be assayed?
Describe the method, devised by Dr. Squibb, for extinguishing mercury.
What is this process termed?
Mercury with chalk—Mention a synonym. How is it made?
What is the object of this preparation?
What is Matter's process for making it?
Describe its appearance, odor, and taste.
How may the following impurities be detected?—Mercurous oxide; mercuric oxide. For what is it used medicinally?
What is the dose?
Ammoniated mercury—Give formula in symbols and molecular weight.
What is the synonym for ammoniated mercury?
How is it made?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Mercurous salt; carbonate.
How is it used?
Corrosive mercuric chloride—Give Latin name, symbolic formula, and synonyms.
Describe the process (formerly official) by which it may be made.
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may it be assayed? Describe the electrolytic method.
In case of poisoning, what are the proper antidotes?
For what is it used medicinally? What preparation is official?
What is the dose?
Mild mercurous chloride—Give Latin name, symbolic formula, and molecular weight.
Describe the process (formerly official) by which it may be made.
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Mercuric chloride; ammoniated mercury.
For what is it used medicinally?
What is the dose? What caution is necessary in prescribing calomel?
Yellow mercurous iodide—Give Latin name, symbolic formula, and molecular weight.
How may it be made?
Describe appearance, odor, taste, chemical reaction, and solubility.
Give the tests for identity. How may an impurity of mercuric iodide be detected?
For what is it used medicinally?
What is the dose?
Red mercuric iodide—Give Latin name, formula in symbols, and common names or synonyms.
How may it be made?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.

How may soluble mercury salts be detected?
What is its use and dose?
Yellow mercuric oxide—How is it prepared?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
What is its use and dose?
Mercuric salicylate—What is its Latin title, and synonyms? How much mercury does it represent?
How may it be prepared?
Describe its appearance, odor, taste, reaction, and tests for identity.
What impurities are likely to be present and how detected?
What are its medicinal uses and the dose?
How may it be prepared for hypodermic administration?
Solution of mercury and potassium iodide—What are its synonyms? How is it prepared?
Give its dose and uses.
Solution of mercuric nitrate—How is it prepared? Describe its appearance, odor, taste, and reaction.
What is its specific gravity?
How is it used medicinally?

CHAPTER XLVII

ANTIMONY, ARSENIC, AND BISMUTH

Sb; 120.2. As; 74.96. Bi; 208.0

THESE three metals, which have the Latin names Antimonium, Arsenium, Bismuthum, form a group which presents several analogies. Arsenic is regarded by a number of chemists as not metallic, and on account of some of its chemical relations it is classed by them with the non-metallic elements, but in some of its physical properties, notably its luster, specific gravity, etc., it closely resembles the metals, and it is therefore considered in the group with antimony and bismuth.

Antimony (Stibium). Sb; 120.2

This metal is found in nature in a free state, but more frequently as a sulphide, oxide, or oxysulphide. The native sulphide (called *antimonite*) is the chief source of the metal, and roasting with iron and sodium sulphide is the process generally resorted to for obtaining it. It is a brittle, brilliant metal, of a lamellated texture, of a silver-white color when pure, but bluish-white as it occurs in commerce. When rubbed between the fingers, it imparts a sensible odor. Its specific gravity is 6.7, and its fusing point 432° C. (809.6° F.), or about a red heat. It forms three combinations with oxygen,—*antimony trioxide* (antimonous oxide), Sb_2O_3; *antimony tetroxide*, Sb_2O_4 (by some considered to be an antimonate of the teroxide of antimony, Sb_4O_8); and *antimony pentoxide* (antimonic oxide), Sb_2O_5. The first of these unites with water to form *ortho-* or meta-antimonous acid, the salts of which are called *meta-antimonites;* the third unites with water to form *ortho-, meta-, or pyro-antimonic acid,* the salts of which are called *ortho-, meta-, or pyro-antimonates.*

Tests for Salts of Antimony

1. If hydrogen sulphide be added to an acidified solution of salt of antimony, an orange-red precipitate of sulphide will be produced. This is soluble in ammonium sulphide, but is again precipitated upon the addition of an acid.

2. If hydrochloric acid be added to the sulphide, so as to form a strong solution of antimonous chloride, and this be mixed with water, a white precipitate of oxychloride will be produced.

3. Zinc and iron precipitate antimony as a black powder from its solutions; copper precipitates it as a metallic film; this may be dissolved by potassium permanganate, and this solution will yield antimony sulphide with hydrogen sulphide.

U. S. P. Salt of Antimony

Official Name	Preparation
Antimonii et Potassii Tartras Tartar Emetic	By boiling antimonous oxide and acid potassium tartrate together with water, evaporating, and crystallizing

N. F. Salts of Antimony

Antimonii Oxidum	By strong ignition of the metal to produce flowers of antimony and by other methods
Antimonium Sulphuratum	By boiling together solutions of purified antimony sulphide and sodium hydroxide, and precipitating with sulphuric acid

Unofficial Salts and Preparations of Antimony

Antimonii Bromidum, $SbBr_3$ Antimony Bromide	By adding dry antimony to bromine contained in a retort, agitating until the combination is complete, then purifying by distillation, and collecting the crystals
Antimonii Fluoridum, SbF_3 Antimony Fluoride	By placing antimony and mercury fluoride in a retort, distilling, and collecting the white mass
Antimonii Iodidum, SbI_3 Antimony Iodide	By direct combination of the elements
Antimonii Oxysulphidum, Sb_2S_3 and Sb_2O_3 Antimony Oxysulphide	By boiling 1 part black antimony with 250 parts water containing 23 parts sodium carbonate, filtering, and collecting the precipitate
Antimonii Pentasulphidum Sb_2S_5 Antimony Pentasulphide	By adding 70 parts crystallized sodium carbonate to 250 parts water and boiling; then mixing with 26 parts lime and 80 parts water; lastly, adding 36 parts levigated antimony sulphide and 7 parts sublimed sulphur, boiling until the gray color disappears, filtering, and then crystallizing
Antimony Sulphas, $Sb_2(SO_4)_3$ Antimony Sulphate	By boiling antimony with strong sulphuric acid, and collecting the white mass
Antimonii Sulphidum, Sb_2S_3 Antimony Trisulphide. U. S. P. 1890	By purifying antimony ore by fusion
Antimonii Sulphidum Purificatum, Sb_2S_3 Purified Antimony Sulphide. U. S. P. 1890	By macerating antimonous sulphide with water containing a trace of ammonia water

ANTIMONII ET POTASSII TARTRAS. U. S. Antimony and Potassium Tartrate

[**Antim. et Pot. Tart.**—Antimonyl Potassium Tartrate Tartrated Antimony Tartar Emetic]

It contains not less than 98.5 per cent. of $K(SbO)C_4H_4O_6+\frac{1}{2}H_2O$ (332.34). Preserve it in well-closed containers.

Preparation.—This, the most important antimonial compound, may be made by a former official process, as follows:

Take of antimony oxide, in very fine powder, 2 oz.; potassium bitartrate, in very fine powder, 2½ oz.; distilled water, 18 fl. oz. To the water, heated to the boiling point in a glass vessel, add the powders, previously mixed, and boil for an hour; then filter the liquid while hot, and set it aside that crystals may form. Lastly, dry the crystals, and keep them in a well-stoppered bottle. By further evaporation, the mother water may be made to yield more crystals, which should be purified by a second crystallization.

Like potassium and sodium tartrate, this is a double salt. Two replaceable hydrogen atoms of tartaric acid ($H_2C_4H_4O_6$) are substituted by one of antimonyl (SbO) and one of potassium (K). The group (SbO) is hypothetical.

$$\underset{\text{Acid Potassium Tartrate}}{2KHC_4H_4O_6} + \underset{\text{Antimonous Oxide}}{Sb_2O_3} = \underset{\text{Antimony and Potassium Tartrate}}{2K(SbO)C_4H_4O_6} + \underset{\text{Water}}{H_2O}$$

Official Description.—It occurs as colorless, transparent crystals of the rhombic system, or as a white granular powder. The crystals effloresce upon exposure to the air.

Odor, Taste, and Reaction.—Without odor, and having a sweet, afterwards disagreeable, metallic taste. Its aqueous solution (1 in 10) is slightly acid to litmus.

Solubility.—One Gm. of Antimony and Potassium Tartrate dissolves in 12 mils of water and in 15 mils of glycerin at 25° C. (77° F.); also in 3 mils of boiling water; insoluble in alcohol.

Tests for Identity.—When heated to redness it chars, emits an odor resembling that of burning sugar, and leaves a blackened residue having an alkaline reaction and imparting a violet color when a small fragment is held in a non-luminous flame.

In an aqueous solution of Antimony and Potassium Tartrate (1 in 20), acidulated with hydrochloric acid, hydrogen sulphide T.S. produces an orange-red precipitate, which is soluble in ammonium sulphide T.S. or potassium hydroxide T.S.

Impurities and Tests for Impurities.—*Iron.*—Ten mils of an aqueous solution of the salt (1 in 100), acidulated with acetic acid, does not at once assume a blue color on the addition of 5 drops of potassium ferrocyanide T.S.

Arsenic.—Dissolve 0.2 Gm. of Antimony and Potassium Tartrate in 5 mils of hydrochloric acid; the solution does not respond to Bettendorf's Test for arsenic (see U. S. P., Test No. 2, Chapter LXII).

Assay.—Dissolve about 0.5 Gm. of Antimony and Potassium Tartrate, accurately weighed, in 30 mils of distilled water, add 25 mils of a cold, saturated solution of sodium bicarbonate and a few drops of starch T.S. and immediately titrate this solution with tenth-normal iodine V.S., to the production of a permanent blue color. It shows not less than 98.5 per cent. of $K(SbO)C_4H_4O_6+\frac{1}{2}H_2O$. Each mil of tenth-normal iodine V.S. used corresponds to 0.016617 Gm. of $K(SbO)C_4H_4O_6+\frac{1}{2}H_2O$. Each gramme of Antimony and Potassium Tartrate corresponds to not less than 59.3 mils of tenth-normal iodine V.S.

U. S. P. Preparations.—Mistura Glycyrrhizæ Composita; Syrupus Scillæ Compositus.

N. F. Preparations.—Pilulæ ad Prandium (Cole's); Vinum Antimonii.

Uses.—Tartar emetic, as its name implies, is used as an emetic, in doses of half a grain to one grain (0.03 to 0.065 Gm.), repeated until vomiting takes place. It is given in one-twelfth grain (0.005 Gm.) doses as an alterative, diaphoretic, or expectorant. In cases of poisoning by an overdose, tannin should be administered in some form, freely; the insoluble tannate is formed.

ANTIMONII OXIDUM. N. F. Antimony Oxide
[Antim. Oxid.]

It contains not less than 97 per cent. of antimonous oxide [Sb_2O_3=288.4].

Preparation.—It may be prepared by pouring a solution of antimonous chloride into a large bulk of water to precipitate the oxychloride and then decomposing this by the addition of sodium carbonate.

Official Description.—It is a white or grayish-white powder.

Odor and Taste.—Odorless and tasteless.

Solubility.—It is insoluble in water, alcohol or nitric acid; readily dissolved by hydrochloric acid without effervescence, and also by a warm aqueous solution of tartaric acid or by a boiling aqueous solution of potassium bitartrate.

Tests for Identity.—When heated Antimony Oxide turns yellow, but it again becomes white on cooling. At a dull red heat it fuses to a yellowish liquid and at a higher temperature it volatilizes.

Dissolve Antimony Oxide in a slight excess of hydrochloric acid and dilute the solution with a large volume of distilled water; a white precipitate is produced which is changed to orange by hydrogen sulphide.

Impurities and Tests for Impurities.—*Sulphate.*—A solution of 0.1 Gm. of the Oxide in 3 mils of hydrochloric acid and 5 mils of distilled water is not rendered turbid at once by a few drops of barium chloride T.S.

Chloride.—A solution of 0.1 Gm. of the Oxide in 10 mils of distilled water and 1 Gm. of tartaric acid does not become more than slightly opalescent on the addition of 0.2 mil of nitric acid and 0.2 mil of silver nitrate T.S.

Copper or Lead.—Dissolve 0.5 Gm. of the Oxide in 10 mils of hydrochloric acid, dilute the solution with distilled water until it begins to become permanently turbid and then precipitate with hydrogen sulphide. This precipitate when thoroughly washed with distilled water dissolves in ammonium sulphide T.S. or sodium sulphide T.S., without leaving a black insoluble residue.

Arsenic.—A solution of 0.1 Gm. of Antimony Oxide in 5 mils of hydrochloric acid does not respond to Bettendorf's Test for arsenic (see U. S. P., Test No. 2, Chapter LXII).

Assay.—Dissolve about 0.2 Gm. of Antimony Oxide, accurately weighed, by warming it in a solution of 1 Gm. of tartaric acid in 10 mils of distilled water (adding a few drops of hydrochloric acid to aid the solution). Nearly neutralize the solution with sodium carbonate, then add 40 mils of a cold saturated solution of sodium bicarbonate and titrate at once with tenth-normal iodine V.S., using starch T.S. as indicator. It shows not less than 97 per cent. of Sb_2O_3. Each mil of tenth-normal iodine V.S. corresponds to 0.00721 Gm. of Sb_2O_3. One gramme of Antimony Oxide corresponds to not less than 134.5 mils of tenth-normal iodine V.S.

N. F. Preparation.—Pulvis Antimonialis.

Uses.—It is rarely given uncombined. It is an ingredient in antimonial powder (see Chapter LXVII). The dose is one grain (0.065 Gm.).

ANTIMONIUM SULPHURATUM. N. F. Sulphurated Antimony

[Antim. Sulphurat.—ANTIMONIUM OXYSULPHURATUM KERMES MINERAL]

Chiefly antimony trisulphide [Sb_2S_3=33.66] with small quantities of antimony trioxide, sodium pyroantimonate, and free sulphur. It contains not less than 45 per cent. of antimony (Sb). Preserve it in well-closed containers, protected from light.

Preparation.—It may be prepared by mixing 100 Gm. of purified antimony sulphide and 1200 mils of solution of sodium hydroxide with 3000 mils of distilled water and boiling the mixture for two hours, with frequent stirring. Then add diluted sulphuric acid until it no longer produces a precipitate, wash the precipitate and dry it at about 25° C. (77° F.).

Official Description.—It occurs as a red-brown powder, becoming lighter in color on exposure to light.

Odor and Taste.—Odorless and tasteless.

Solubility.—Insoluble in water and in alcohol.

Tests for Identity.—One gramme of Sulphurated Antimony, warmed with 10 mils of hydrochloric acid, dissolves with the evolution of hydrogen sulphide, leaving a small amount of residue composed chiefly of sulphur. Its hydrochloric acid solution, after the removal of the hydrogen sulphide by boiling, yields a white precipitate when greatly diluted with water; the liquid separated from this precipitate yields an orange-red precipitate with hydrogen sulphide.

Impurities and Tests for Impurities.—*Calcium.*—Shake about 1 Gm. of Sulphurated Antimony with 20 mils of distilled water and filter. The filtered liquid is neutral to litmus and a portion of it remains clear upon the addition of ammonium oxalate T.S.

Sulphate.—Another portion does not become more than slightly turbid upon the addition of barium chloride T.S.

Arsenic.—Boil 1 Gm. of Sulphurated Antimony with 100 mils of distilled water until the volume is reduced to about 10 mils, filter it and thoroughly wash the residue on the filter with distilled water. The combined filtrate and washings, after evaporation to about 1 mil, does not respond to Bettendorf's Test for arsenic (see U. S. P., Test No.2, Chapter LXII).

Mix about 1 Gm. of Sulphurated Antimony, accurately weighed, with 20 mils of hydrochloric acid and then add 5 Gm. of tartaric acid dissolved in 20 mils of distilled water. Heat the mixture on a water bath until the vapors evolved no longer blacken lead acetate test paper, then filter, wash the residue on the filter until the washings are neutral to litmus and dry it at 100° C. (212° F.). The weight of this residue does not exceed 4 per cent. of the weight of Sulphurated Antimony taken, and it should burn with the odor of sulphur dioxide, leaving an ash not exceeding 0.2 per cent. of the Sulphurated Antimony taken.

Assay.—Dilute the combined filtrate and washings from the preceding test to 200 mils. Neutralize 50 mils of this solution with sodium carbonate, add 25 mils of a cold saturated aqueous solution of sodium bicarbonate and at once titrate with tenth-normal iodine V.S., using starch T.S. as indicator. It shows not less than 45 per cent. of antimony. Each mil of tenth-normal iodine V.S. corresponds to 0.00601 Gm. of antimony (Sb). Each gramme of Sulphurated Antimony requires not less than 74.9 mils of tenth-normal iodine V.S.

N. F. Preparation.—Pilulæ Antimonii Compositæ.

Uses.—Used as an alterative, emetic, and diaphoretic in doses of one to five grains (0.065 to 0.3 Gm.). It is an ingredient in Plummer's Pills (see Chapter LXVII).

Arsenic. As; 74.96

Arsenic is found in many minerals, generally as sulphides (*realgar* and *orpiment*) or an arsenide. It may be easily obtained from arsenous oxide by heating it with charcoal. Arsenic is a brilliant crystalline element, of a steel-gray color when freshly sublimed; upon exposure to the air its surface becomes blackish and dull. Its specific gravity is 5.63 to 5.73. It forms two combinations with oxygen, arsenous and arsenic oxides, As_2O_3 and As_2O_5 respectively, the corresponding acids to the first being *arsenous acid* (H_3AsO_3), (known only in solution) and *metarsenous acid* ($HAsO_2$) (known only in salts) and to the second *orthoarsenic acid* (H_3AsO_4), *pyroarsenic acid* ($H_4As_2O_7$), and *meta-arsenic acid* ($HAsO_3$), and three with sulphur,—namely, the disulphide, or *realgar*, As_2S_2; the trisulphide, or *orpiment*, As_2S_3, corresponding in composition to arsenous oxide; and the pentasulphide, As_2S_5, corresponding to arsenic oxide.

Tests for Arsenic and its Salts

1. Hydrogen sulphide, when added to an acidulated solution of arsenic trioxide, produces a bright yellow precipitate (orpiment). This is soluble in ammonia water and reprecipitated by acids.
2. If silver nitrate is added to a solution of arsenic trioxide, with a small quantity of ammonia water, a yellow precipitate (silver arsenite) is produced. This precipitate is soluble in an excess of ammonia, and also in nitric acid.
3. If cupric sulphate is added to a solution of arsenic trioxide, with a small quantity of ammonia water, a green precipitate (Scheele's green) is produced. This precipitate is soluble in an excess of ammonia.
4. If a liquid containing arsenic be added to a flask containing zinc and sulphuric acid, the hydrogen gas produced will upon ignition deposit a ring of metallic arsenic upon a cold surface (Marsh's test).
5. If a thin piece of bright copper plate be placed in an acidulated arsenical solution, and the latter be heated, a film of metallic arsenic will be deposited upon it (Reinsch's test).
6. (See U. S. P. Arsenic Tests, Nos. 1 and 2, Chapter LXII).

U. S. P. Salts and Solutions of Arsenic

Official Name	Preparation
Liquor Acidi Arsenosi	10 Gm. arsenic trioxide, 50 Gm. diluted hydrochloric acid, distilled water to make 1000 Gm.
Potassii Arsenitis	10 Gm. arsenic trioxide, 20 Gm. potassium bicarbonate, 30 Gm. compound tincture of lavender, distilled water to make 1000 Gm.
Sodii Arsenas	By fusing arsenic trioxide with sodium nitrate and sodium carbonate
Arsenas Exsiccatus	By heating sodium arsenate to 150° C. (302° F.) until it ceases to lose weight
Liquor Sodii Arsenatis	By dissolving 1 Gm. exsiccated sodium arsenate in sufficient distilled water to make 100 Gm.
Arseni Iodidum	By fusing 1 part metallic arsenic and 5 parts iodine together and purifying the product
Arseni Trioxidum	By roasting arsenical ores and resubliming the sublimate
Liquor Arseni et Hydrargyri Iodidi	By dissolving 10 Gm. each of arsenous iodide and red mercuric iodide in sufficient distilled water to make 1000 Gm.

N. F. Solutions of Arsenic

Liquor Arsenicalis, Clemens	By dissolving 10 Gm. of arsenic trioxide, and 40.5 Gm. of potassium bicarbonate, in 200 mils of water with heat, then adding 5 mils of bromine and water to make 1000 mils
Liquor Auri et Arseni Bromidi	By combining 2.5 Gm. of arsenic trioxide, and 4 Gm. of bromine by heating it with 135 mils of water, then adding 3.25 Gm. of bromauric acid and enough water to make 1000 mils
Liquor Sodii Arsenatis, Pearson	By dissolving 0.1 Gm. of exsiccated sodium arsenate in enough distilled water to make 100 Gm.

Unofficial Compounds of Arsenic

Arseni Bromidum, $AsBr_3$ Arsenic Bromide	By diffusing arsenic in powder in a retort filled with bromine vapor, then distilling the arsenic bromide from the excess of arsenic
Arseni Chloridum, $AsCl_3$ Arsenic Chloride	By direct combination of arsenic and chlorine
Arseni Disulphidum, As_2S_2 Arsenic Disulphide	By fusing together 5 parts arsenic trioxide and 3 parts sulphur, then collecting the mass
Arseni Trisulphidum, As_2S_3 Arsenic Trisulphide	By fusing 5 parts arsenic trioxide with 4 to 5 parts sulphur, then collecting the mass

ARSENI TRIOXIDUM. U. S. Arsenic Trioxide

[**Arsen. Triox.**—ARSENOUS ACID ARSENOUS OXIDE WHITE ARSENIC]

It contains, when dried to constant weight at 100° C. (212° F.), not less than 99.8 per cent. of As_2O_3 (197.92).

Preparation.—Arsenic trioxide, or, as it is commonly termed, *arsenic*, is made by roasting arsenical ores in reverberatory furnaces with long, horizontal flues; the arsenic trioxide collects as a solid sublimate, which is afterwards resublimed in cast iron vessels with conical heads. Chemically, it is an oxide, As_2O_3, the acid being formed when the oxide is dissolved in water.

$$\underset{\text{Arsenic Trioxide}}{2As_2O_3} + \underset{\text{Water}}{6H_2O} = \underset{\text{Arsenous Acid}}{4H_3AsO_3}$$

Official Description.—It occurs either as an opaque, white powder, or in irregular masses of two varieties: one, amorphous, transparent, and colorless, like glass; the other, crystalline, opaque, and white, resembling porcelain. Frequently the same piece has an opaque, white outer crust enclosing the glassy variety. Contact with moist air gradually changes the glassy into the white, opaque variety.

Odor and Reaction.—Both varieties are odorless. An aqueous solution of Arsenic Trioxide is faintly acid to litmus.

Solubility.—Arsenic Trioxide is soluble in water, the amorphous or glassy variety being somewhat more soluble than the crystalline variety; it is slightly soluble in alcohol and in ether and freely soluble in glycerin and is dissolved by hydrochloric acid and alkaline solutions.

Impurities and Tests for Impurities.—*Arsenous Sulphide.*—When slowly heated in a dry test tube of hard glass, Arsenic Trioxide yields a sublimate of minute, brilliant, transparent, octahedral crystals and does not show a yellow color. When heated rapidly to about 200° C. (392° F.), the amorphous variety fuses, then sublimes, while the crystalline variety sublimes without fusing. Not more than 0.1 per cent. of residue remains after sublimation. When covered with charcoal in an ignition tube, and strongly heated, Arsenic Trioxide is reduced, and metallic arsenic is deposited on the cooler portion of the tube as a mirror, having a metallic luster, and this mirror is readily dissolved by solutions of sodium or calcium hypochlorite.

Antimony, Tin, and Cadmium.—Hydrogen sulphide T.S. colors an aqueous solution of Arsenic Trioxide (1 in 100) yellow; on adding a few drops of hydrochloric acid to the colored solution, a lemon-yellow precipitate of arsenic trisulphide is produced, which is completely soluble in ammonium carbonate T.S.

Dissolve 1 Gm. of Arsenic Trioxide in 10 mils of ammonia water with the aid of a gentle heat; a colorless solution is produced.

Assay.—Dissolve about 0.2 Gm. of Arsenic Trioxide, previously dried to constant weight at 100° C. (212° F.) and accurately weighed, in 20 mils of boiling distilled water by the gradual addition of sodium hydroxide T.S. until complete solution results. Neutralize this solution with diluted sulphuric acid V.S., using phenolphthalein T.S. as indicator, cool, dissolve in it 2 Gm. of sodium bicarbonate and titrate the mixture with tenth-normal iodine V.S., using starch T.S. as indicator. It shows, in the dried Arsenic Trioxide, not less than 99.8 per cent. of As_2O_3. Each mil of tenth-normal iodine V.S. used corresponds to 0.004948 Gm. of As_2O_3. Each gramme of Arsenic Trioxide, dried to constant weight, corresponds to not less than 201.7 mils of tenth-normal iodine V.S.

U. S. P. Preparations.—Liquor Acidi Arsenosi; Liquor Potassii Arsenitis.

N. F. Preparations.—Liquor Arsenicalis, Clemens; Liquor Auri et Arseni Bromidi; Pilulæ Ferri, Quininæ, Strychninæ et Arseni Fortiores; Pilulæ Ferri, Quininæ, Strychninæ et Arseni Mites.

Uses.—Arsenic trioxide is used as an alterative, in doses of one-thirtieth of a grain (0.002 Gm.); externally, it is employed as an escharotic, and, mixed with various substances in the form of a paste, is often applied to cancers and ulcers. An antidote to arsenical poisoning is official (see page 872).

LIQUOR ACIDI ARSENOSI. U. S. Solution of Arsenous Acid

[**Liq. Acid. Arsen.**—HYDROCHLORIC SOLUTION OF ARSENIC SOLUTION OF ARSENIC CHLORIDE]

An aqueous solution, containing arsenous acid equivalent to not less than 0.975 per cent. nor more than 1.025 per cent. of As_2O_3(197.92).

	Metric	Old form
***Arsenic Trioxide,** in fine powder	**10 Gm.**	70 grains
Diluted Hydrochloric Acid	**50 Gm.**	350 grains
Distilled Water, a sufficient quantity,		
To make	**1000 Gm.**	16 oz. av.

Mix the diluted hydrochloric acid with 250 Gm. [or measure, old form, 4 fl. oz.] of distilled water in a tared flask, add the arsenic trioxide, and boil until the arsenic trioxide is completely dissolved. Then allow it to cool, add enough distilled water to make the product weigh 1000 Gm. [old form 16 oz. av.] and filter.

This is simply a solution of arsenous acid in diluted hydrochloric acid, no chemical action taking place.

Official Description.—It is a clear, colorless liquid.

Odor, Taste, and Reaction.—Odorless, having an acidulous taste and an acid reaction.

Tests for Identity.—Hydrogen sulphide T.S., added to Solution of Arsenous Acid, produces a lemon-yellow precipitate of arsenic trisulphide which is completely soluble in ammonium carbonate T.S.

Assay.—Dilute about 20 mils of Solution of Arsenous Acid, accurately weighed, with about 50 mils of distilled water, dissolve 2 Gm. of sodium bicarbonate in this solution and titrate with tenth-normal iodine V.S., using starch T.S. as indicator. It shows not less than 0.975 per cent. nor more than 1.025 per cent. of As_2O_3. Each mil of tenth-normal iodine V.S. used corresponds to 0.004948 Gm. of As_2O_3. Each gramme of Solution of Arsenous Acid corresponds to not less than 1.97 nor more than 2.07 mils of tenth-normal iodine V.S.

Uses.—Solution of arsenous acid is used as an alterative, in doses of two to five minims (0.12 to 0.3 mil).

LIQUOR POTASSII ARSENITIS. U. S. Solution of Potassium Arsenite

[Liq. Pot. Arsen.—Fowler's Solution Liquor arsenicalis Fowleri P.I.]

An aqueous solution containing potassium arsenite, corresponding in amount to not less than 0.975 per cent. nor more than 1.025 per cent. of As_2O_3 (197.92). Preserve the solution in amber-colored bottles.

	Metric	Old form
***Arsenic Trioxide,** in fine powder	10 Gm.	70 grains
Potassium Bicarbonate	20 Gm.	140 grains
Compound Tincture of Lavender	30 Gm.	210 grains
Distilled Water, a sufficient quantity,		
To make	1000 Gm.	16 oz. av.

Boil the arsenic trioxide and potassium bicarbonate in a tared flask with 100 Gm. [or measure, old form, 1½ fl. oz.] of distilled water, until solution has been effected, and then add enough distilled water to make the solution weigh 970 Gm. [old form 15 oz. av. 228 gr.]; then add the compound tincture of lavender and filter through paper.

$$\underset{\text{Acid Potassium Carbonate}}{2KHCO_3} + \underset{\text{Arsenic Trioxide}}{As_2O_3} + \underset{\text{Water}}{H_2O} = \underset{\text{Potassium Arsenite}}{2KH_2AsO_3} + \underset{\text{Carbon Dioxide}}{2CO_2}$$

When arsenic trioxide is boiled with acid potassium carbonate in concentrated solution, carbon dioxide is evolved, and potassium arsenite is produced; but, owing to the fact that the salts are soluble in the quantity of water directed in the formula, a solution can be effected without involving any chemical change. The proportionate quantity of potassium bicarbonate was doubled in the U. S. P 1890. The corresponding British solution (Liquor Arsenicalis) is made from dilute solutions, and its title does not indicate any chemical action.

Official Description.—It is a clear or faintly opalescent liquid with a pink color.

Odor and Reaction.—It has a slight odor of lavender and it is alkaline to litmus.

Tests for Identity.—Acidulate strongly 10 mils of the Solution with hydrochloric acid and add an equal volume of hydrogen sulphide T.S.; a yellow precipitate is produced which dissolves in ammonium carbonate T.S.

Impurities and Tests for Impurities.—*Arsenate.*—Acidulate 4 mils of Solution of Potassium Arsenite with diluted nitric acid, add 1 mil of silver nitrate T.S. and superimpose a layer of ammonia water upon this liquid; no red or reddish-brown color is observed at the line of contact.

Assay.—Dilute about 20 mils of Solution of Potassium Arsenite, accurately weighed, with 75 mils of distilled water, acidify the mixture very slightly with diluted hydrochloric acid, then dissolve in the solution 2 Gm. of sodium bicarbonate and titrate the resulting liquid with tenth-normal iodine V.S., starch T.S. being used as indicator. It shows not less than 0.975 per cent. nor more than 1.025 per cent. of As_2O_3. Each mil of tenth-normal iodine V.S. used corresponds to 0.004948 Gm. of As_2O_3. Each gramme of Solution of Potassium Arsenite corresponds to not less than 1.97 nor more than 2.07 mils of tenth-normal iodine V.S.

Uses.—Solution of potassium arsenite is largely used as an alterative, in doses of three to five minims (0.2 to 0.3 mil).

SODII ARSENAS. U. S. Sodium Arsenate

$Na_2HAsO_4+7H_2O=312.08$

For an account of the preparation and uses of this salt, see page 743.

SODII ARSENAS EXSICCATUS. U. S. Exsiccated Sodium Arsenate

$Na_2HAsO_4 = 185.97$

For the official method of preparation and its uses, see page 744.

LIQUOR SODII ARSENATIS. U. S. Solution of Sodium Arsenate

[Liq. Sod. Arsen.]

An aqueous solution containing not less than 0.975 per cent. nor more than 1.025 per cent. of Na_2HAsO_4 (185.97).

	Metric	Old form
***Exsiccated Sodium Arsenate,** previously dried to constant weight at 150° C. (302° F.)............	**1 Gm.**	35 grains
Distilled Water, a sufficient quantity,		
To make..................................	**100 Gm.**	8 oz. av.

Dissolve the exsiccated sodium arsenate in sufficient distilled water to make the product weigh 100 Gm. [old form 8 oz. av.].

Tests for Identity and Impurities.—The Solution conforms to the reactions and tests for an aqueous solution of the salt as given under *Sodii Arsenas Exsiccatus*, when concentrated to proper strength.

Assay.—Pour into a tared flask about 30 mils of Solution of Sodium Arsenate, weigh accurately, heat to 80° C. (176° F.), and add 10 mils of hydrochloric acid and 3 Gm. of potassium iodide. Allow the mixture to stand for fifteen minutes at 80° C. (176° F.), in a glass-stoppered flask, cool and then titrate with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator. It shows not less than 0.975 per cent. nor more than 1.025 per cent. of Na_2HAsO_4. Each mil of tenth-normal sodium thiosulphate V.S. used corresponds to 0.0092985 Gm. of Na_2HAsO_4. Each gramme of Solution of Sodium Arsenate corresponds to not less than 1.05 mils nor more than 1.10 mils of tenth-normal sodium thiosulphate V.S.

Uses.—This solution is used as an alterative in doses of three to five minims (0.2 to 0.3 mil).

ARSENI IODIDUM. U. S. Arsenous Iodide

[Arsen. Iod.—ARSENIC IODIDE]

It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99 per cent. of AsI_3 (455.72). Preserve it in amber-colored, glass-stoppered vials, in a cool place, protected from light.

Preparation.—In the former official process this iodide was made by a direct combination of the elements.

Take of arsenic trioxide, 60 grains; iodine, 300 grains. Rub the arsenic trioxide in a mortar until reduced to a fine powder; then add the iodine, and rub them together until they are thoroughly mixed. Put the mixture into a small flask or a test tube, loosely stoppered, and heat it very gently until liquefaction occurs. Then incline the vessel in different directions, in order that any portion of the iodine, which may have condensed on its surface, may be returned into the melted mass. Lastly, pour the melted iodine on a porcelain slab, and when it is cold break it into pieces, and keep it in a well-stoppered bottle.

By this process it is difficult to secure entire combination, but a purer salt can be made if the pieces be rubbed in a mortar to powder, chloroform added until as much as possible be dissolved, the solution evaporated, and the crystalline powder washed and dried. A better process consists in pouring a solution of 10 Gm. of arsenic trioxide in 250 mils of hydrochloric acid into a solution of 51 Gm. of potassium iodide in 40 mils of hot water, extracting the residue with chloroform, evaporating the solution, and washing and drying the crystalline powder.

Official Description.—It is an orange-red, crystalline powder, stable when protected from direct sunlight and kept in a cool place.

Odor.—Inodorous.

Solubility.—One Gm. of Arsenous Iodide dissolves in about 12 mils of water at 25° C. (77° F.), with partial decomposition; soluble in alcohol, chloroform, ether, or carbon disulphide.

Tests for Identity.—No loss of iodine occurs when dry Arsenous Iodide is heated on a water bath, but at higher temperatures it volatilizes, leaving not more than 0.5 per cent. of residue. When warmed with a few drops of nitric acid, brown vapors of nitrogen oxides are evolved, followed by violet vapors of iodine.

A freshly prepared aqueous solution of the salt is colorless, but upon standing it gradually decomposes with the formation of arsenous and hydriodic acids and becomes yellow.

Add hydrogen sulphide T.S. to an aqueous solution of Arsenous Iodide, acidulated with hydrochloric acid; a lemon-yellow precipitate of arsenous sulphide is produced.

Add 1 mil of chlorine water to 5 mils of an aqueous solution of the salt (1 in 20); iodine is liberated and imparts to the solution a light reddish-brown color. Agitate this mixture with 1 mil of chloroform; the latter acquires a violet color.

Assay.—Proceed as directed under the Assay for iodides (see U. S. P., Test No. 5, Chapter LXII), using about 0.5 Gm. of Arsenous Iodide, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed. It shows, in the dried salt, not less than 99 per cent. of AsI_3. Each mil of tenth-normal silver nitrate V.S. corresponds to 0.015191 Gm. of AsI_3. Each gramme of Arsenous Iodide, dried to constant weight, corresponds to not less than 65.2 mils of tenth-normal silver nitrate V.S.

U. S. P. Preparation.—Liquor Arseni et Hydrargyri Iodidi.

Uses.—The principal use of this salt is in making solution of arsenous and mercuric iodides. The dose is one-twelfth of a grain (0.005 Gm.) as an alterative.

LIQUOR ARSENI ET HYDRARGYRI IODIDI. U. S. Solution of Arsenous and Mercuric Iodide

[**Liq. Arsen. et Hydrarg. Iod.**—DONOVAN'S SOLUTION]

An aqueous solution containing not less than 0.95 per cent. nor more than 1.05 per cent. of AsI_3 (455.72) and not less than 0.95 per cent. nor more than 1.05 per cent. of HgI_2 (454.44).

	Metric	Old form
***Arsenous Iodide**	10 Gm.	70 grains
Red Mercuric Iodide	10 Gm.	70 grains
Distilled Water, a sufficient quantity,		
To make	1000 Gm.	16 oz. av.

Rub the arsenous iodide and red mercuric iodide together in a mortar, add 150 mils [old form 2½ fl. oz.] of distilled water, and continue the trituration until solution is effected. Filter the solution, and pass sufficient distilled water through the filter to make the product weigh 1000 Gm. [old form 16 oz. av.]. Mix thoroughly. Preserve it in well-filled, amber-colored bottles. It must not be dispensed if darker than pale yellow.

This solution, in which no chemical change occurs, should be of a light straw color; when darker than this, free iodine is probably present, and if a globule of mercury or a few grains of metallic arsenic are dropped into the bottle containing the solution, and the whole well agitated and filtered, the proper color may be restored.

Official Description.—It is a clear, colorless or pale yellowish liquid.

Odor and Taste.—Without odor, and having a disagreeable, metallic taste.

Tests for Identity.—One mil of Solution of Arsenous and Mercuric Iodide, mixed with 10 mils of distilled water, to which a few drops of lead acetate T.S. have been added, produces a bright yellow precipitate.

Add a few drops of Solution of Arsenous and Mercuric Iodide to a mixture of about 0.5 Gm. of zinc and 5 mils of diluted hydrochloric acid in a test tube, and cover the mouth of the test tube with a filter paper which has been moistened with mercuric chloride T.S. and dried; a yellow stain appears upon the inner surface of the filter paper within one minute.

Assay for Arsenous Iodide.—Introduce about 25 mils of Solution of Arsenous and Mercuric Iodide into a flask, weigh accurately, dilute with 25 mils of distilled water, then dissolve 2 Gm. of sodium bicarbonate in this solution and titrate it with tenth-normal iodine V.S., using starch T.S. as indicator. It shows not less than 0.95 per cent. nor more than 1.05 per cent. of AsI_3. Each mil of tenth-normal iodine V.S. used corresponds to 0.022786 Gm. of AsI_3. Each gramme of Solution of Arsenous and Mercuric Iodide corresponds to not less than 0.42 mil nor more than 0.46 mil of tenth-normal iodine V.S.

Assay for Mercuric Iodide.—Introduce about 25 mils of Solution of Arsenous and Mercuric Iodide into a tared flask, weigh accurately, add 5 mils of potassium hydroxide T.S. and 5 mils of solution of formaldehyde, and warm the mixture on a water bath until the mercuric salt has been completely reduced to metallic mercury. Carefully decant the clear, supernatant liquid from the residue of metallic mercury and wash the mercury carefully by decantation, with two successive portions of 25 mils each of distilled water. Dissolve the residue of metallic mercury in 5 mils of nitric acid, dilute the solution with 50 mils of distilled water, add 2 mils of ferric ammonium sulphate T.S. and titrate with tenth-normal potassium sulphocyanate V.S. to the formation of a permanent pink color. It shows not less than 0.95 per cent. nor more than 1.05 per cent. of HgI_2. Each mil of tenth-normal potassium sulphocyanate V.S. corresponds to 0.022722 Gm. of HgI_2. Each gramme of Solution of Arsenous and Mercuric Iodide corresponds to not less than 0.42 mil nor more than 0.46 mil of tenth-normal potassium sulphocyanate V.S.

Uses.—Solution of arsenous and mercuric iodides is used as an alterative. The dose is from one and one-half to three minims (0.1 to 0.2 mil), largely diluted.

LIQUOR ARSENICALIS, CLEMENS. N. F. Clemens' Solution of Arsenic

[**Liq. Arsen., Clemens.**—LIQUOR POTASSII ARSENATIS ET BROMIDI, N. F. III
SOLUTION OF POTASSIUM ARSENATE AND BROMIDE]

An aqueous solution containing an amount of arsenic in combination corresponding to about 1 per cent. of arsenic trioxide [As_2O_3].

	Metric	Old form
Arsenic Trioxide	**10.0 Gm.**	**146 gr.**
Potassium Bicarbonate	**40.5 Gm.**	**1 oz. av. 154 gr.**
Bromine	**5.0 mils**	**77 min.**
Water, a sufficient quantity,		
To make	**1000 mils**	**2 pints**

Boil the arsenic trioxide with the potassium bicarbonate, and 200 mils [old form about 6½ fl. oz.] of water, until solution is effected. Allow this to cool, add 500 mils [old form 1 pint] of water, then the bromine, and afterwards sufficient water to make the product measure 1000 mils [old form 2 pints]. Allow the mixture to stand during twelve hours, agitating it occasionally, then filter.

Uses.—It is used as an alterative in doses of two to five minims (0.12 to 0.3 mil).

LIQUOR AURI ET ARSENI BROMIDI. N. F. Solution of Gold and Arsenic Bromide

[Liq. Aur. et Arsen. Brom.

	Metric	Old form
Arsenic Trioxide	2.50 Gm.	36½ grains
Bromauric Acid	3.25 Gm.	47 grains
Bromine	4.00 Gm.	58 grains
Distilled Water, a sufficient quantity,		
To make	1000 mils	2 pints

Place the arsenic trioxide and bromine in a flask, add 135 mils [old form 4 fl. oz. 154 min.] of distilled water and heat the mixture gently until solution is effected and all free bromine has disappeared. Then add bromine water, *twenty* to *thirty* drops at a time, until it is present in slight excess, or until the solution does not become colorless after standing thirty minutes. Transfer the solution to a porcelain dish, expel the excess of bromine with the aid of gentle heat, and dilute it with distilled water to about 600 mils [old form 19 fl. oz. 96 min.]. Dissolve the bromauric acid in this solution and add sufficient distilled water to make the product measure 1000 mils [old form 2 pints].

Average Dose.—3 minims (0.2 mil).

LIQUOR SODII ARSENATIS, PEARSON. N. F. Pearson's Solution of Sodium Arsenate

[Liq. Sod. Arsen., Pearson.—LIQUOR ARSENICALIS PEARSONII]

	Metric	Old form
Exsiccated Sodium Arsenate	0.1 Gm.	3½ grains
Distilled Water, a sufficient quantity		
To make	100 Gm.	8 oz. av.

Dissolve the exsiccated sodium arsenate in the distilled water, and filter the solution.

Uses.—This solution is used as an alterative in doses of thirty minims (2 mils), but it must not be confounded with the Liquor Sodii Arsenatis, U. S. P., *which is ten times as strong as the above preparation.*

Bismuth. Bi; 208.0

Bismuth is found in the metallic state, and occasionally as a sulphide, known as *Bismuthine* (Bi_2S_3). It is a crystalline, brittle, pulverizable, brilliant metal, having a silver color, with a reddish tint. Its specific gravity is 9.8. It closely resembles metallic antimony in appearance.

Tests for Salts of Bismuth

1. Hydrogen sulphide or ammonium sulphide produces in solutions of bismuth salts a black precipitate of sulphide, insoluble in excess.
2. When acid solutions of bismuth salts are poured into water, white precipitates (subsalts) are produced.

U. S. P. Salts and Preparations of Bismuth

Official Name	Preparation
Bismuthi Betanaphtholas	By the action of an alkaline solution of betanaphthol on a solution of bismuth trinitrate in dilute glycerin or acid
et Ammonii Citras	By dissolving bismuth citrate in ammonia water, evaporating the solution, and scaling
Subcarbonas	By dissolving bismuth in nitric acid, purifying, and precipitating by adding solution of sodium carbonate
Subgallas	By dissolving normal bismuth nitrate in glacial acetic acid, adding to the liquid an aqueous solution of gallic acid, collecting, washing, and drying the precipitate
Subnitras	By dissolving bismuth in nitric acid, purifying, and adding the solution in nitric acid to water
Subsalicylas	By dissolving normal bismuth nitrate in glycerin, adding the solution to a strong aqueous solution of sodium salicylate, collecting, washing, and drying the precipitate
Magma Bismuthi	By pouring a solution of bismuth nitrate into a solution of ammonia water and ammonium carbonate

N. F. Preparations of Bismuth

Glyceritum Bismuthi	A glycerin solution of bismuth and sodium tartrate
Liquor Bismuthi	A dilution of glycerite of bismuth

Unofficial Salts of Bismuth

Bismuthi Bromidum, $BiBr_3$ Bismuth Bromide	By treating bismuth with excess of bromine and collecting the steel gray mass
Bismuthi Chromas, $3Bi_2O_3.2CrO_3$ Bismuth Chromate	By adding a solution of bismuth nitrate to a moderately concentrated solution of acid potassium chromate in slight excess, and collecting the precipitate
Bismuthi et Ferri Citras Bismuth and Iron Citrate	A soluble salt containing about 40 per cent. each of bismuth citrate and ferric citrate
Bismuthi et Lithii Citras Bismuth and Lithium Citrate	A soluble salt containing from 40 to 45 per cent. of bismuth and from 2.5 to 3 per cent. of lithium
Bismuthi Iodosubgallas Bismuth Oxyiodogallate Airol	A combination of bismuth oxyiodide and gallic acid. Used as a substitute for iodoform
Bismuthi Lactas Bismuth Lactate	By boiling 10 parts bismuth subnitrate with excess of sodium hydroxide, washing the oxide well with water, then mixing with 9 parts lactic acid, digesting the mixture, and drying with the aid of a water bath
Bismuthi Methylene Digallas Bismal	A compound of bismuth hydroxide and methylenedigallic acid. Used as an astringent in chronic diarrhœa in 2 to 5 grain doses
Bismuthi Oxalas, $C_6Bi_2O_{12}.15H_2O$ Bismuth Oxalate	By mixing bismuth nitrate with a solution of oxalic acid, and collecting the precipitate
Bismuthi Oxidum, Bi_2O_3 Bismuth Oxide	By mixing 4 oz. bismuth subnitrate and 1 pint solution of sodium hydroxide, then boiling for 5 minutes, decanting the liquid, and washing the precipitate with distilled water
Bismuthi Oxychloridum, $BiOCl$ Bismuth Oxychloride	By pouring slowly a solution of bismuth in nitric acid into a solution of sodium chloride, and collecting the precipitate
Bismuthi Phosphas, $BiPO_4$ Bismuth Phosphate	By adding bismuth nitrate to a solution of phosphoric acid containing nitric acid, and collecting the precipitate
Bismuthi Tannas Bismuth Tannate	By dissolving 22 parts bismuth nitrate in the least amount of nitric acid, previously diluted with half its weight of water, pouring the solution into an excess of solution of sodium hydroxide, washing the precipitate with water, then triturating the precipitate with 10 parts tannic acid diluted with water, straining, and drying
Bismuthi Tartras Bismuth Tartrate	By adding a hot, concentrated solution of 4 parts tartaric acid to a hot, moderately strong solution of 5 parts bismuth oxide in nitric acid, then washing the precipitate with an aqueous solution of tartaric acid
Bismuthi Tribromphenas Bismuth Tribromphenate	Used as an antiseptic dusting powder, as a substitute for iodoform, and internally in dysentery. In cholera infantum in a dose of from 15 to 45 grains
Bismuthi Valeras Bismuth Valerate	By dissolving bismuth nitrate in the smallest amount of nitric acid, previously diluted with half its weight of water, then adding a concentrated solution of sodium valerate, washing the precipitate with water mixed with valeric acid, and, lastly, drying the precipitate

BISMUTHI BETANAPHTHOLAS. U. S. **Bismuth Betanaphthol**

[Bism. Betanaph.]

A compound of bismuth and betanaphthol of somewhat varying composition, yielding not less than 15 per cent. of betanaphthol [$C_{10}H_7OH$] and, upon ignition, not less than 73 per cent. nor more than 78 per cent. of bismuth oxide [Bi_2O_3].

Preparation.—It may be prepared by mixing sodium naphtholate with bismuth nitrate or by the action of an alkaline solution of betanaphthol on a solution of bismuth nitrate in dilute glycerin or acid. The formula is approximately $(BiO)_2 OHC_{10}H_7O$.

Official Description.—It is a buff-colored to grayish-brown, amorphous powder; permanent in the air.

Odor, Taste, and Reaction.—Odorless or having a faint odor of betanaphthol; tasteless. Shake about 0.5 Gm. of Bismuth Betanaphthol with 10 mils of distilled water and filter; the filtrate is colorless and neutral to litmus.

Solubility.—Bismuth Betanaphthol is nearly insoluble in water, alcohol, chloroform or ether; partially dissolved by mineral acids with the formation of the corresponding bismuth salts and the liberation of betanaphthol.

Test for Identity.—When strongly heated Bismuth Betanaphthol chars and finally leaves a grayish-yellow residue, which is blackened by hydrogen sulphide T.S.

Impurities and Tests for Impurities.—*Free Betanaphthol.*—Shake about 1 Gm. of Bismuth Betanaphthol, accurately weighed, with 20 mils of chloroform, filter the mixture, allow the filtrate to evaporate spontaneously and dry the residue in a desiccator over sulphuric acid; the weight of this residue does not exceed 1 per cent.

Nitrates.—Heat gently a mixture of about 0.2 Gm. of Bismuth Betanaphthol with 5 mils of potassium hydroxide T.S. and about 0.2 Gm. of aluminum wire; the vapors evolved do not turn red litmus blue.

Lead, Copper, Sulphate, or Silver.—Incinerate about 2 Gm. of Bismuth Betanaphthol in a porcelain crucible, cool the residue and add just sufficient nitric acid to form a solution with the aid of heat. This solution, when poured into 100 mils of distilled water, produces a white, crystalline precipitate. Now filter the mixture, evaporate the filtrate to 30 mils and again filter if not clear; the clear filtrate does not respond to the tests given under *Bismuthi Subcarbonas.*

Arsenic.—The bismuth oxide obtained in the following assay does not respond to Bettendorf's Test for arsenic (see U. S. P., Test No. 2, Chapter LXII).

Assay for Betanaphthol.—Dissolve about 2 Gm. of Bismuth Betanaphthol, accurately weighed, in 20 mils of hydrochloric acid with the aid of heat, cool the liquid and then shake it in a separator with successive portions of chloroform until the extraction of the betanaphthol is complete. Combine the chloroform solutions, allow the liquid to evaporate spontaneously and dry the residue in a desiccator; the weight of the residue corresponds to not less than 15 per cent. of the weight of Bismuth Betanaphthol taken. This residue, crystallized from a solution in boiling distilled water, responds to the tests for identity under *Betanaphthol.*

Assay for Bismuth Oxide.—Incinerate about 2 Gm. of Bismuth Betanaphthol, accurately weighed, in a porcelain crucible, cool the residue and dissolve it in nitric acid. Evaporate the solution to dryness and carefully ignite the residue until of constant weight; the bismuth oxide (Bi_2O_3) so obtained corresponds to not less than 73 per cent. nor more than 78 per cent. of the original weight of the Bismuth Betanaphthol taken.

Uses.—It is employed as an intestinal antiseptic, the betanaphthol being liberated. The dose is eight to fifteen grains (0.5 to 1 Gm.).

BISMUTHI ET AMMONII CITRAS. U. S. Bismuth and Ammonium Citrate

[Bism. et Ammon. Cit.—BISMUTH AMMONIO-CITRATE]

Bismuth citrate rendered soluble by the presence of ammonium citrate; when dried to constant weight in a desiccator over sulphuric acid, it yields, upon ignition, not less than 46 per cent. nor more than 52 per cent. of bismuth oxide [Bi_2O_3]. Preserve in well-closed containers, protected from light.

Preparation.—The manufacturing detail was omitted from the U. S. P. IX; the U. S. P. VIII process was as follows:

Mix 100 Gm. [old form 1 oz. av.] bismuth citrate with 200 mils [old form 2 fl. oz.] of distilled water and rub it to a smooth paste, heat the mixture on a water bath, and gradually add ammonia water until the salt is dissolved and the liquid is neutral or has only a faintly alkaline reaction. Then filter the solution, evaporate it on a water bath to a syrupy consistence, and spread it upon plates of glass so that, when dry, the salt may be obtained in scales. Keep the product in amber-colored, well-stoppered bottles, protected from light.

This is the only U. S. P. soluble salt of bismuth, but the N. F. contains a glycerin solution of bismuth and sodium tartrate (see pages 376 and 953) which is more stable than the ammonia salt. If an aqueous solution of bismuth and ammonium citrate is not perfectly transparent, it is probably due to the loss of ammonia on keeping the salt; a drop or two of ammonia water added to a cloudy solution will generally make it transparent.

Official Description.—It occurs in shining, pearly or translucent scales, or white powder, becoming opaque with loss of ammonia on exposure to the air.

Odor, Taste, and Reaction.—Odorless and of a metallic taste. An aqueous solution of Bismuth and Ammonium Citrate (1 in 20) is neutral or faintly acid to litmus.

Solubility.—Bismuth and Ammonium Citrate is very soluble in water and sparingly soluble in alcohol.

Tests for Identity.—When strongly heated, it fuses and finally leaves a blackened residue, having a yellow surface. A solution of this residue in a slight excess of nitric or hydrochloric acid produces a white turbidity when added to 25 volumes of distilled water.

Ammonia is evolved when Bismuth and Ammonium Citrate is boiled with a slight excess of sodium hydroxide T.S.

An aqueous solution of the Bismuth and Ammonium Citrate, when treated with an excess of hydrogen sulphide, yields a black precipitate. The filtrate from the latter, when deprived by heat of the excess of hydrogen sulphide and boiled with an excess of lime water, yields a white precipitate.

Impurities and Tests for Impurities.—*Nitrate.*—Dissolve about 0.05 Gm. of Bismuth and Ammonium Citrate in 1 mil of distilled water, in a test tube, add 5 mils of sulphuric acid (free from nitrous compounds), cool the mixture and carefully pour over it 5 mils of ferrous sulphate T.S. without mixing; no red or brown zone appears immediately.

Alkalies or Alkali Earths.—Dissolve 1 Gm. of Bismuth and Ammonium Citrate in 50 mils of distilled water, precipitate the bismuth completely with hydrogen sulphide, filter, evaporate the filtrate to dryness and ignite. The weight of the residue does not exceed 0.005 Gm.

Lead, Copper, Sulphate, or Silver.—Ignite 3 Gm. of the Bismuth and Ammonium Citrate, dissolve the residue in just a sufficient quantity of warm nitric acid, and pour the solution into 100 mils of distilled water; a white precipitate is produced. Filter this mixture, evaporate the filtrate on a water bath to 30 mils, again filter the liquid and divide the new filtrate into portions of 5 mils each. These portions do not respond to the tests under *Bismuthi Subcarbonas.*

Arsenic.—The residue resulting from the ignition and subsequent treatment of 2 Gm. of Bismuth and Ammonium Citrate, as described in the following test, does not respond to Bettendorf's Test for arsenic (see U. S. P., Test No. 2, Chapter LXII).

Assay.—Take about 1 Gm. of Bismuth and Ammonium Citrate, previously dried to constant weight in a desiccator over sulphuric acid, and weigh accurately. Ignite in a porcelain crucible and, after cooling, add 5 mils of nitric acid to the residue, drop by drop, warming until solution is effected. Evaporate this solution to dryness, and carefully ignite it at red heat. It leaves a residue of bismuth oxide (Bi_2O_3) corresponding to not less than 46 per cent. nor more than 52 per cent. of the original weight of Bismuth and Ammonium Citrate taken.

Uses.—This salt is astringent, and is generally prescribed in solution. The dose is from one to three grains (0.065 to 0.2 Gm.)

BISMUTHI SUBCARBONAS. U. S. **Bismuth Subcarbonate**

[Bism. Subcarb.]

A basic bismuth carbonate of varying chemical composition, which, when dried to constant weight at 100° C. (212° F.), yields, upon ignition, not less than 90 per cent. of bismuth oxide [Bi_2O_3].

Preparation.—Bismuth subcarbonate may be made as follows:

Take of bismuth in pieces, 2 oz. troy; nitric acid, 8½ oz. troy; ammonia water, 5 fl. oz.; sodium carbonate, 10 oz. troy; distilled water, a sufficient quantity. Mix 4½ oz. troy of the nitric acid with 4 fl. oz. of distilled water in a capacious glass vessel, and, having added the bismuth, set the whole aside for twenty-four hours, dilute the resulting solution with 10 fl. oz. of distilled water, stir it thoroughly, and, after twenty-four hours, filter through paper. To the filtered liquid, previously diluted with 4 pints of distilled water, slowly add the ammonia water, constantly stirring. Transfer the whole to a strainer, and, after the precipitate has been drained, wash it with two pints of distilled water, and drain it again. Then place the precipitate in a proper vessel, add the remainder of the nitric acid, and afterwards 4 fl. oz. of distilled water, and set the solution aside. At the end of twenty-four hours, filter through paper. Dissolve the sodium carbonate in 12 fl. oz. of distilled water, with the aid of heat, and filter the solution through paper. To this, when cold, slowly add the solution of nitrate of bismuth, with constant stirring. Transfer the whole to a strainer, and, after the precipitate has been drained, wash it with distilled water until the washings pass tasteless. Lastly, press, dry it on bibulous paper with a gentle heat, and rub it into a powder.

As metallic bismuth generally contains arsenic, it is very important to provide that this should be left behind, in the processes for making its medicinal preparations. It is on this account that the above formula is so elaborate. The bismuth is first dissolved in nitric acid, a portion of which oxidizes the metal, with the evolution of nitrous vapors, while another portion combines with the oxide produced to form bismuth nitrate. At the same time the arsenic is also oxidized at the expense of the nitric acid, and unites with a portion of the oxidized metal so as to produce bismuth arsenate. Both of these salts, therefore, are contained in the solution, which is very concentrated. Both have the property, when their solution is diluted with water, of separating into two salts, one an insoluble subsalt which is deposited, and the other a soluble acid salt which is held in solution. But the arsenate is more disposed to the change than the nitrate, and requires for the purpose a smaller amount of water of dilution. The subarsenate is slowly deposited in twenty-four hours, and is then separated by filtration. The addition of a large quantity of distilled water precipitates the bismuth subnitrate, the ammonia being added to separate it more thoroughly by combining with the nitric acid. The precipitate, thus freed from arsenic, is now redissolved in nitric acid partially diluted and added to solution of sodium carbonate; by double decomposition, bismuth subcarbonate and sodium nitrate are thus produced. The chemical formula is approximately $[(BiO)_2CO_3]_2 + H_2O$.

Official Description.—It is a white or pale yellowish-white powder; permanent in the air.

Odor and Taste.—Odorless and tasteless.

Solubility.—Bismuth Subcarbonate is insoluble in water or alcohol; completely dissolved by nitric or hydrochloric acid with copious effervescence.

Tests for Identity.—Its solution in a slight excess of nitric acid, when added to 25 volumes of distilled water, produces a white turbidity.

When heated to redness, the salt loses water and carbon dioxide, and leaves a yellowish residue, which is soluble in nitric or hydrochloric acid and blackened by hydrogen sulphide T.S.

Impurities and Tests for Impurities.—*Chloride.*—Dissolve 1 Gm. of the salt in 2 mils of nitric acid, add distilled water to make the solution measure 25 mils, then add 0.35 mil of tenth-normal silver nitrate V.S. and remove the precipitate, if any, by filtration; the clear filtrate remains unaffected by the further addition of a few drops of silver nitrate T.S.

Dissolve 3 Gm. of the salt in just a sufficient quantity (about 4 mils) of warm nitric acid, and pour the solution into 100 mils of distilled water; a white precipitate is produced. Filter, and evaporate the filtrate on a water bath to 30 mils, again filter the liquid, divide the latter filtrate into portions of 5 mils each and subject these several portions to the following tests:

Lead.—Mix one portion with an equal volume of diluted sulphuric acid; it does not become cloudy.

Copper.—Precipitate another portion with a slight excess of ammonia water; the supernatant liquid does not exhibit a bluish tint.

Sulphate.—Another portion is not immediately affected by barium nitrate T. S.

Silver.—In another portion, hydrochloric acid does not produce a precipitate which is insoluble in a slight excess of hydrochloric acid, but soluble in ammonia water.

Alkalies or Alkali Earths.—Boil 1 Gm. of the salt with 20 mils of a mixture of equal parts of acetic acid and distilled water, cool the solution and filter. Free the filtrate from bismuth by the addition of hydrogen sulphide, boil the mixture and again filter. The latter filtrate leaves not more than 0.003 Gm. of residue on evaporation and gentle ignition.

Nitrate.—Agitate about 0.05 Gm. of Bismuth Subcarbonate with 5 mils of a solution of equal parts of distilled water and ferrous sulphate T.S., and cautiously pour the mixture over 5 mils of sulphuric acid (free from nitrous compounds), so as to form a layer above; no brownish-red zone forms at the line of contact of the two liquids.

Arsenic.—The residue resulting from the ignition of 2 Gm. of Bismuth Subcarbonate does not respond to Bettendorf's Test for arsenic (see U. S. P., Test No. 2, Chapter LXII).

Assay.—Ignite thoroughly at red heat in a porcelain crucible about 1 Gm. of Bismuth Subcarbonate, previously dried to constant weight at 100° C. (212° F.) and accurately weighed. The residue of bismuth oxide (Bi_2O_3) corresponds to not less than 90 per cent. of the original weight of Bismuth Subcarbonate taken.

Uses.—This bismuth compound is astringent and tonic. It is employed for the same purposes as the subnitrate, but is to be preferred to the nitrate in mixtures containing carbonates, as the acidity, often noticed in the nitrate, frequently causes decomposition or explosion in capsules, pills, etc.; the latter, however, is much more frequently used.

The dose is from five to ten grains (0.3 to 0.65 Gm.).

BISMUTHI SUBGALLAS. U. S. Bismuth Subgallate

[**Bism. Subgal.**—DERMATOL]

A basic bismuth gallate of varying chemical composition which, when dried to constant weight at 100° C. (212° F.), yields, upon ignition, not less than 52 per cent. nor more than 57 per cent. of bismuth oxide [Bi_2O_3].

Preparation.—Bismuth subgallate may be made by dissolving bismuth subnitrate in diluted acetic acid and precipitating the solution with gallic acid, but a more convenient and rapid method is that of Thibault, which is as follows: Bismuth trioxide is triturated with water, and an excess of pure gallic acid added, continuing the trituration until the color of the mixture has changed to a greenish-yellow. It is allowed to stand twenty-four hours, washed and dried. The chemical formula is approximately $Bi(OH)_2C_7H_5O_5$.

Official Description.—It is an amorphous, bright yellow powder; permanent in the air.

Odor and Taste.—Odorless and tasteless.

Solubility.—Bismuth Subgallate is insoluble in water, alcohol, or ether; readily soluble, with decomposition, in warm hydrochloric, nitric or sulphuric acid; insoluble in very dilute mineral acids; readily soluble in alkali hydroxide solutions, forming a clear, yellow solution which rapidly changes to a deep red.

Tests for Identity.—When heated to redness it at first chars, leaving finally a yellow residue, which is blackened by hydrogen sulphide T.S. A solution of this residue in a slight excess of warm nitric or hydrochloric acid produces a white turbidity when added to 25 volumes of distilled water.

Agitate thoroughly about 0.1 Gm. of Bismuth Sulgallate with an excess of hydrogen sulphide T.S.; a brownish-black precipitate results. Filter this mixture, boil the filtrate to remove the dissolved gas, and then cool; the addition of 1 drop of ferric chloride T.S. produces a blue-black coloration in the liquid.

Impurities and Tests for Impurities.—*Free Gallic Acid.*—Shake 1 Gm. of the salt with 20 mils of alcohol for one minute, filter and evaporate the filtrate to dryness on a water bath; not more than 0.005 Gm. of residue remains.

Alkalies or Alkali Earths.—Boil 1 Gm. of Bismuth Subgallate with 20 mils of a mixture of equal parts of acetic acid and distilled water, cool the solution and filter. Free the filtrate from bismuth by the addition of hydrogen sulphide, boil the mixture and again filter. The latter filtrate leaves not more than 0.005 Gm. of residue on evaporation and gentle ignition.

Nitrate.—Mix thoroughly about 0.005 Gm. of Bismuth Subgallate with 5 mils of diluted sulphuric acid and 5 mils of ferrous sulphate T.S., filter the mixture and then cautiously pour the filtrate, without mixing, over 5 mils of sulphuric acid (free from nitrous compounds), contained in a test tube; no brownish-red zone forms immediately.

Lead, Copper, Sulphate, or Silver.—Ignite 3 Gm. of Bismuth Subgallate in a porcelain crucible, cool and cautiously add just sufficient nitric acid, drop by drop, warming until the residue is dissolved. Evaporate the solution to dryness, again ignite and cool. Cautiously dissolve this residue in just sufficient nitric acid by the aid of gentle heat, concentrate the solution to about 4 mils, pour it into 100 mils of distilled water, filter, evaporate the filtrate on a water bath to 30 mils, again filter and divide this filtrate into portions of 5 mils each. These portions do not respond to the tests under *Bismuthi Subcarbonas.*

Arsenic.—The residue resulting from the ignition and subsequent treatment of 2 Gm. of Bismuth Subgallate as described in the following test does not respond to Bettendorf's Test for arsenic (see U. S. P., Test No. 2, Chapter LXII).

Assay.—Take about 1 Gm. of Bismuth Subgallate, previously dried to constant weight at 100° C. (212° F.) and weighed accurately. Ignite in a porcelain crucible and, after cooling, add 5 mils of nitric acid to the residue, drop by drop, warming until complete solution has been effected. Evaporate this solution to dryness and carefully ignite at red heat; it leaves a residue of bismuth oxide (Bi_2O_3) corresponding to not less than 52 per cent. nor more than 57 per cent. of the original weight of Bismuth Subgallate taken.

Uses.—Bismuth subgallate has been used as an astringent sedative in doses of eight to fifteen grains (0.5 to 1 Gm.); it is more valuable as an external application to wounds and ulcerations and in the treatment of eczema.

BISMUTHI SUBNITRAS. U. S. Bismuth Subnitrate.
[Bism. Subnit.]

A basic bismuth nitrate of varying chemical composition, which, when dried for twenty-four hours in a desiccator over sulphuric acid, yields, upon ignition, not less than 79 per cent. of bismuth oxide [Bi_2O_3].

Preparation.—This important salt may be made by the former official process, as follows:

Take the bismuth, in pieces, 2 oz. troy; nitric acid, 8½ oz. troy; sodium carbonate, 10 oz. troy; ammonia water, 5 fl. oz.; distilled water, a sufficient quantity. Mix 4½ oz. troy of the nitric acid with 4 fl. oz. of distilled water, in a capacious glass vessel, and, having added the bismuth, set the whole aside for twenty-four hours. Dilute the resulting solution with 10 fl. oz. of distilled water, stir it thoroughly, and, after twenty-four hours, filter through paper. Dissolve the sodium carbonate in 20 fl. oz. of distilled water with the aid of heat, and filter the solution through paper. To this, when cold, slowly add the solution of bismuth nitrate, with constant stirring. Transfer the whole to a strainer, and, after the precipitate has been drained, wash it with distilled water until the washings pass tasteless, and drain as completely as possible. Then place the moist precipitate in a capacious vessel, gradually add the remainder of the nitric acid, and afterwards 4 fl. oz. of distilled water, and set the solution aside. At the end of twenty-four hours, filter through paper and to the filtered liquid, previously diluted with 4 pints of distilled water, slowly add the ammonia water, with constant stirring. Transfer the whole to a strainer, and, after the precipitate has been drained, wash it with 2 pints of distilled water, drain it again, and press out as much of the liquid as possible. Lastly, dry it upon bibulous paper with a gentle heat, and rub it into powder.

The separation of the arsenic is accomplished by first preparing the carbonate, by adding the acid solution of bismuth to a solution of sodium carbonate in excess, whereby most of the arsenic is retained in the solution, probably as sodium arsenate, while the insoluble carbonate is precipitated. This is dissolved, with the aid of heat, in nitric acid, so as to make a very concentrated solution of the nitrate, to which, when cold, just so much water is added as to begin to produce a permanent turbidity. The object of this is to allow any arsenic that may be still present to be deposited, which happens for reasons stated in explaining the process for procuring the subcarbonate (see page 947). The deposited matter having been precipitated, only the pure nitrate remains in solution, which is made to yield the subnitrate by large dilution with water, and still more completely by the addition of ammonia.

$$\underset{\text{Bismuth}}{Bi_2} + \underset{\text{Nitric Acid}}{8HNO_3} = \underset{\text{Bismuth Nitrate}}{2Bi(NO_3)_3} + \underset{\text{Water}}{4H_2O} + \underset{\text{Nitrogen Dioxide}}{N_2O_2}$$

then

$$\underset{\substack{\text{Bismuth}\\\text{Nitrate}}}{5Bi(NO_3)_3} + \underset{\text{Water}}{8H_2O} = \underset{\text{Bismuth Subnitrate}}{4BiONO_3.H_2O} + \underset{\substack{\text{Bismuth}\\\text{Nitrate}}}{Bi(NO_3)_3} + \underset{\substack{\text{Nitric}\\\text{Acid}}}{8HNO_3}$$

The chemical formula is approximately $Bi(OH)_2NO_3$.

Official Description.—It is a white powder; slightly hygroscopic.

Odor, Taste, and Reaction.—Odorless, almost tasteless. When brought in contact with moistened blue litmus paper, the salt shows a slightly acid reaction.

Solubility.—Bismuth Subnitrate is almost insoluble in water, insoluble in alcohol, and readily dissolved by hydrochloric or nitric acid.

Tests for Identity.—Its solution in a slight excess of warm nitric or hydrochloric acid produces a white turbidity when added to 25 volumes of distilled water.

When heated to redness it evolves nitrous vapors, leaving a yellow residue, which is blackened by hydrogen sulphide T.S.

Impurities and Tests for Impurities.—*Alkalies or Alkali Earths.*—Boil 1 Gm. of Bismuth Subnitrate with 20 mils of a mixture of equal parts of acetic acid and distilled water, cool the solution and filter. Free the filtrate from bismuth by the addition of hydrogen sulphide, boil the mixture and again filter. The latter filtrate leaves not more than 0.003 Gm. of residue on evaporation and gentle ignition.

Boil about 0.1 Gm. of the salt with 5 mils of potassium hydroxide T.S.; no odor of ammonia is perceptible nor does the vapor turn moistened red litmus paper blue.

Arsenic.—The residue resulting from the ignition of 2 Gm. of the salt does not respond to Bettendorf's Test for arsenic (see U. S. P., Test No. 2, Chapter LXII).

Carbonate.—Add 3 Gm. of the salt to 3 mils of warm nitric acid; no effervescence occurs and

Insoluble Foreign Salts.—No residue remains.

Lead, Copper, Sulphate, or Silver.—Pour this solution into 100 mils of distilled water, a white precipitate is produced. Filter, evaporate the filtrate on a water bath to 30 mils, again filter the liquid and divide the new filtrate into portions of 5 mils each. These portions do not respond to the tests under *Bismuthi Subcarbonas.*

Assay.—Ignite thoroughly at red heat in a porcelain crucible about 1 Gm. of Bismuth Subnitrate, previously dried for twenty-four hours in a desiccator over sulphuric acid and accurately weighed. The residue of bismuth oxide (Bi_2O_3) corresponds to not less than 79 per cent. of the original weight of Bismuth Subnitrate taken.

U. S. P. Preparation.—Magma Bismuthi.

N. F. Preparations.—Glyceritum Bismuthi; Unguentum Resorcinolis Compositum.

Uses.—Bismuth subnitrate is largely used in intestinal disorders; it is an astringent, tonic, and sedative. The dose is from three to ten grains (0.2 to 0.6 Gm.).

BISMUTHI SUBSALICYLAS. U. S. Bismuth Subsalicylate
[Bism. Subsalicy.]

A basic bismuth salicylate of varying chemical composition, which, when dried to constant weight at 100° C. (212° F.), yields, upon ignition, not less than 62 per cent. nor more than 66 per cent. of bismuth oxide [Bi_2O_3]. Protect it from light.

Preparation.—Bismuth Subsalicylate is apt to be an unstable salt. It may be made by Thibault's process, as follows: 15 Gm. of crystallized bismuth nitrate dissolved in nitric acid are precipitated by an excess of solution of sodium hydroxide. After boiling, the whole of the amorphous, white, hydrated oxide is transformed into yellow crystallized anhydrous oxide; it is then thoroughly washed, and 10 Gm. of salicylic acid, rubbed up with 200 mils of water, are added. The whole is then left on the water bath, and when there are no more opaque, yellow needles of anhydrous oxide left, it is thoroughly washed with cold alcohol, and dried in an oven. The chemical formula is approximately $Bi(OH)_2C_7H_5O_3$.

Official Description.—It is a white, or nearly white, amorphous or crystalline powder; permanent in the air.

Odor and Taste.—Odorless and tasteless.

Solubility.—Bismuth Subsalicylate is almost insoluble in cold water; upon prolonged boiling with water a portion of the salicylic acid passes into solution with the formation of a more basic bismuth subsalicylate. It is partly soluble, with decomposition, in hydrochloric or nitric acid, a white, flocculent precipitate of salicylic acid separating.

Tests for Identity.—When heated to redness it at first chars, finally leaving a yellow residue, which is blackened by hydrogen sulphide. A solution of this residue in a slight excess of warm nitric or hydrochloric acid produces a white turbidity when added to 25 volumes of distilled water.

Agitate about 0.1 Gm. of Bismuth Subsalicylate with a solution of 5 drops of ferric chloride T.S. in 10 mils of distilled water; a deep violet-blue coloration is produced.

Impurities and Tests for Impurities.—*Free Salicylic Acid.*—Agitate 1 Gm. of the salt with 20 mils of chloroform, filter the liquid and evaporate the filtrate to dryness; not more than 0.005 Gm. of residue remains.

Lead, Copper, Sulphate, or Silver.—Ignite 3 Gm. of Bismuth Subsalicylate in a porcelain crucible, cool and cautiously add just sufficient nitric acid to the residue, drop by drop, warming until it is dissolved. Pour this solution into 100 mils of distilled water, filter, evaporate the filtrate on a water bath to 30 mils, again filter and divide the filtrate into portions of 5 mils each. These portions do not respond to the tests under *Bismuthi Subcarbonas.*

Alkalies or Alkali Earths.—Boil 1 Gm. of Bismuth Subsalicylate with 20 mils of a mixture of equal parts of acetic acid and distilled water, cool the solution and filter. Free the filtrate from bismuth by the addition of hydrogen sulphide, boil the mixture and again filter. The latter filtrate, on evaporation and ignition, leaves not more than 0.005 Gm. of residue.

Nitrate.—Triturate about 0.05 Gm. of Bismuth Subsalicylate with 0.1 Gm. of sodium salicylate and 5 mils of distilled water, and carefully pour it without mixing over 5 mils of sulphuric acid (free from nitrous compounds) contained in a test tube; no pink to brownish-red zone forms immediately.

Arsenic.—The residue resulting from the ignition and subsequent treatment of 2 Gm. of Bismuth Subsalicylate, as described in the test below, does not respond to Bettendorf's Test for arsenic (see U. S. P., Test No. 2, Chapter LXII).

Assay.—Take about 1 Gm. of Bismuth Subsalicylate, previously dried to constant weight at 100° C. (212° F.), and weigh accurately. Ignite in a porcelain crucible, and, after cooling, add 5 mils of nitric acid to the residue, drop by drop, warming until solution has been effected. Evaporate this solution to dryness and carefully ignite it at red heat. It leaves a residue of bismuth oxide (Bi_2O_3) corresponding to not less than 62 per cent. nor more than 66 per cent. of the original weight of Bismuth Subsalicylate taken.

Uses.—This salt is used as an intestinal antiseptic in doses of from five to fifteen grains (0.3 to 1 Gm.).

MAGMA BISMUTHI. U. S. Bismuth Magma

[**Magma Bism.**—MILK OF BISMUTH CREAM OF BISMUTH]

Bismuth Magma yields not less than 5.6 per cent. nor more than 6.2 per cent. of Bi_2O_3.

	Metric	Old form
*Bismuth Subnitrate	80 Gm.	2 oz. av. 293 gr.
Nitric Acid	120 mils	3 fl. oz. 403 min.
Ammonium Carbonate	10 Gm.	146 gr.
Ammonia Water,		
Distilled Water, each, a sufficient quantity,		
To make	1000 mils	2 pints

Mix the bismuth subnitrate with 60 mils [old form 1 fl. oz. 442 min.] of distilled water and 60 mils [old form 1 fl. oz. 442 min.] of nitric acid in a flask and agitate, warming gently until solution is effected. Pour this solution, with constant stirring, into 5000 mils [old form 10 pints] of distilled water containing 60 mils [old form 1 fl. oz. 442 min.] of nitric acid. Dilute 480 mils [old form 15 fl. oz. 173 min.] of ammonia water with 4000 mils [old form 8 pints] of distilled water in a glazed or glass vessel of at least 12000 mils [old form 3 gallons] capacity. Dissolve the ammonium carbonate in this solution and then quickly pour the bismuth solution into it with constant stirring. If the mixture is not distinctly alkaline, add sufficient ammonia water to make it so and allow it to stand until the precipitate has subsided, then pour or siphon off the supernatant liquid and wash the precipitate twice with distilled water, by decantation. Afterwards transfer the magma to a strainer of close texture, arranged in a percolator so as to provide continuous washing with distilled water, the outlet tube being elevated to prevent the surface of the magma from becoming dry, and allow the operation to proceed until the washings cease to react with phenolphthalein T.S. Then drain the moist magma, transfer it to a graduated vessel and add sufficient distilled water to make the product measure 1000 mils [old form 2 pints]. Mix thoroughly, transfer to bottles and stopper tightly.

Official Description.—A thick, white, opaque liquid containing bismuth hydroxide and bismuth subcarbonate in suspension in water.

Reaction.—Neutral to litmus and phenolphthalein.

Tests for Identity.—One mil of hydrochloric acid added to 1 mil of Bismuth Magma produces a clear solution. Pour the clear solution into 10 volumes of distilled water; a white precipitate is produced.

Assay.—Evaporate to dryness about 10 Gm. of Bismuth Magma, accurately weighed, and ignite the residue to constant weight; the residue corresponds to not less than 5.6 per cent. nor more than 6.2 per cent. of the weight of Bismuth Magma taken.

Uses.—It is used for the same purposes as bismuth subnitrate in doses of one fluidrachm (4 mils).

GLYCERITUM BISMUTHI. N. F. Glycerite of Bismuth.

One hundred mils of Glycerite of Bismuth yields not less than 12.8 Gm. of bismuth oxide.

The formula and comments will be found on page 376. The following description and tests are provided:

Official Description.—A colorless or pale yellow liquid.

Odor and Taste.—It has a slight odor, and a sweet, followed by a saline taste.

Specific Gravity.—About 1.378 at 25° C. (77° F.).

Assay.—Dilute 5 mils of Glycerite of Bismuth, accurately measured, with 100 mils of distilled water, in a flask, add two drops of hydrochloric acid, and pass a current of hydrogen sulphide through the solution until it is saturated. Allow the precipitate to settle and decant the supernatant liquid (which should be clear and colorless) through a filter, retaining the precipitate in the flask. Wash the precipitate six times by decantation. Then mix 10 mils of nitric acid with 10 mils of distilled water, heat the mixture to 80° C. (176° F.) and pass it through the filter, collecting it in the flask with the precipitate. Warm the mixture until the bismuth sulphide is dissolved, then filter the liquid through a small filter, and wash the filter and residue with warm 10 per cent. nitric acid until free from bismuth salts. To the clear filtrate add ammonia water until a slight, permanent precipitate appears, then add a slight excess of ammonium carbonate T.S. Heat the liquid on a steam bath during one hour, then collect the precipitate on an analytical filter, wash it thoroughly with distilled water, dry and ignite it in the usual manner. The weight of bismuth oxide so obtained is not less than 0.640 Gm.

Uses.—It is used chiefly in the preparation of the solution and elixirs of the N. F.

LIQUOR BISMUTHI. N. F. Solution of Bismuth
[Liq. Bism.]

	Metric	Old form
Glycerite of Bismuth	**125 mils**	**4 fl. oz.**
Alcohol	**125 mils**	**4 fl. oz.**
Distilled Water, a sufficient quantity,		
To make	**1000 mils**	2 pints

Mix the glycerite of bismuth with 750 mils [old form 1½ pints] of distilled water, then add the alcohol and finally sufficient distilled water to make the product measure 1000 mils [old form 2 pints].

Uses.—This is an astringent and is used in diarrhœa but should never be given when acute inflammation is present. The dose is about one fluidrachm (4 mils).

QUESTIONS ON ANTIMONY, ARSENIC, AND BISMUTH

Antimony—Give Latin name, symbol, and atomic weight. (See page 932.)
What is its melting point? How is it found?
What combinations does it form with oxygen?
From which of these oxides are antimonites formed?
From which of these oxides are antimoniates formed?
What are the tests for salts of antimony?
Antimony and potassium tartrate—Give Latin name, formula in symbols, synonyms, and molecular weight.
Describe the process (formerly official) by which this may be made.
Describe odor, taste, chemical reaction, and solubility. What are the tests for identity?
How may the following impurities be detected?—viz.: Iron; arsenic.
In case of poisoning by an overdose, what is the proper antidote?
For what is it used medicinally and what is the dose?
Antimony oxide—What is the chemical formula? How may it be prepared?
Describe odor, taste, chemical reaction, and solubility. What are the tests for identity?
How may the following impurities be detected?—Chloride; sulphate; copper; lead; arsenic.
In what N. F. preparations is it used?
Sulphurated antimony—What is the Latin title; give the synonyms.
What is sulphurated antimony and how much antimony does it represent?
How may it be prepared?
Describe its appearance, odor, and taste. Give its solubility and tests for identity.
What impurities are likely to be present and how may they be detected?
What are its uses and the dose?
Arsenic—Give the Latin name, symbol, and atomic weight.
Where is it found, and how is it obtained?
What combinations does it form with oxygen?
What combinations does it form with sulphur?
What are the tests for arsenic and its salts?
Arsenic trioxide—Give Latin name and formula in symbols.
What are the synonyms?
How is it made?
Chemically, is it regarded as an acid? What is true arsenous acid?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity and impurities.
What are its uses and the dose?
What are the official antidotes to arsenical poisoning?
Solution of arsenous acid—Give Latin name and synonyms.
How is it made?
Describe its appearance, odor, taste, reaction, and tests for identity. What is the dose?
Solution of potassium arsenite—What is the Latin name?
By what name is this solution commonly known?
How is it made?
Wherein does it differ from the British "liquor arsenicalis"?
How may its quality be tested? What is the dose?
Sodium arsenate—Give Latin name and formula in symbols.
Exsiccated sodium arsenate—What is the Latin title?
Solution of sodium arsenate—What is the official Latin title?
How is it made? For what is it used? What is the dose?
Arsenous iodide—Give Latin name, formula in symbols, and synonym.
How may it be prepared by a formerly official process?
What objection is there to this process? How otherwise may it be made?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
For what is it used chiefly? What is the dose?
Solution of arsenous and mercuric iodide—Give the Latin name. How is it made?
What is the common name or synonym by which the solution is known?
Give a description of the odor and taste.
How may the color of the solution, which has become dark upon standing, be restored? What does this color usually indicate? What is the dose?

What is Clemens' solution of arsenic? Give the synonyms.
How is it prepared? How much arsenic is present? Give the uses and the dose.
Solution of gold and arsenic bromide—What is the Latin title?
How is it prepared? How much arsenic is present? Give the dose.
Pearson's solution of sodium arsenate—What is the Latin title and synonym? How is it prepared?
How does its arsenic strength compare with the U. S. P. solution of sodium arsenate? What is its use and dose?
Bismuth—Give the symbol and atomic weight.
Give description and specific gravity.
How is it found? What are tests for salts of bismuth?
Give its molecular weight.
Bismuth and ammonium citrate—What is its synonym? How much bismuth oxide does it represent? How is it made?
Why is the solution of this salt sometimes not perfectly transparent and how may it be made so? What N. F. preparation contains a salt of bismuth similar to this? What are its advantages? What are its uses and the dose?
Bismuth betanaphthol—What is the Latin title? Of what does this compound consist? How may it be prepared? Describe it appearance, odor, taste, and reaction. Give solubilities and tests for identity. What impurities are likely to be present and how may they be detected? What are its uses and the dose?
Bismuth subcarbonate—What is this salt chemically? How much bismuth oxide should it yield?
Why is such an elaborate process adopted for obtaining this salt? What is the chemical formula, approximately?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Chlorides; lead; copper; sulphate; silver; alkalies and alkali earths; nitrate; arsenic.
For what is it used medicinally? What is the dose?
Bismuth subgallate—What is the Latin title? By what name is it commonly known?
How may it be prepared? What is its chemical formula, approximately?
Describe its appearance, odor, taste and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Free gallic acid; alkalies or alkali earths; nitrate; lead; copper; sulphate; silver; arsenic.
For what is it used? What is the dose?
Bismuth subnitrate—What is it chemically? How is the separation of arsenic accomplished?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Alkalies or alkali earths; carbonate; insoluble foreign salts; lead; copper; sulphate; silver; arsenic. For what is it used? What is the dose?
Bismuth subsalicylate—What is the Latin title? What is it chemically? Describe Thibault's process for making it. Describe appearance, odor, taste, and solubility. Give the tests for identity.
How may the following impurities be detected?—viz.: Free salicylic acid; alkalies or alkali earths; nitrate; arsenic.
For what is it used and in what dose?
Bismuth magma—What is the Latin title? Give the synonyms. How much bismuth oxide should it represent?
How may it be prepared?
Describe appearance, reaction and tests for identity.
Glycerite of bismuth—How may it be prepared?
Describe its appearance, odor, and taste.
Give its specific gravity. For what is it used?
Solution of bismuth—What is the Latin title? How is it made?
What are its uses and the dose?

CHAPTER XLVIII

GOLD AND PLATINUM

Au; 197.2   Pt; 195.2

SALTS of these precious metals are official—the gold salt as a substance in the materia medica, the platinum salt as a test solution; both are chlorides. Gold and platinum are both found native in the free state. Latin names for these metals are Aurum and Platinum.

Tests for Gold Salts

1. If hydrogen sulphide is added to the solution of a gold salt, a dark brown, almost black, precipitate (auric sulphide) will be produced, soluble in ammonium sulphide.
2. If ferrous sulphate is added to a solution of a gold salt, metallic gold in the form of a fine precipitate will be produced; this may be fused into a button of gold by the use of the blowpipe.
3. Stannous chloride, if added to dilute solutions of gold salts, produces a purple precipitate (purple of Cassius).

Tests for Platinum Salts

1. If hydrogen sulphide or ammonium sulphide is added to a solution of platinic chloride, a brown precipitate of platinic sulphide will be produced, soluble in excess of ammonium sulphide.
2. If a solution of potassium chloride is added to a solution of platinic chloride acidulated with hydrochloric acid, a yellow precipitate (double chloride) will be formed.

U. S. P. Salts of Gold and Platinum

Official Name	Preparation
Auri et Sodii Chloridum	Equal parts of anhydrous gold chloride and anhydrous sodium chloride
Test solution of platinic chloride	Dissolve 2.6 parts of platinic chloride in 20 parts of distilled water

N. F. Preparation of Gold

Acidum Bromauricum	This is a true chemical compound of gold bromide and hydrobromic acid

Unofficial Salts of Gold

Auri Bromidum, $AuBr_3$ Gold Bromide	By dissolving gold in a mixture of nitric and hydrobromic acids, concentrating, then crystallizing
Auri Chloridum, $AuCl_3$ Gold Chloride	By dissolving gold in nitrohydrochloric acid, concentrating carefully, then crystallizing (see Test Solution U. S. P., Chapter LXII)
Auri Iodidum, AuI_3 Gold Iodide	By gradually adding a neutral solution of auric chloride to a solution of potassium iodide, then collecting and drying the precipitate

AURI ET SODII CHLORIDUM. U. S. Gold and Sodium Chloride [Aur. et Sod. Chlor.]

A mixture of equal parts of anhydrous gold chloride [$AuCl_3 = 303.58$] and anhydrous sodium chloride [$NaCl = 58.46$], representing, when dried to constant weight in a desiccator over sulphuric acid, not less than 30 per cent. of metallic gold [Au]. Preserve it in well-stoppered amber-colored vials.

Preparation.—It may be made by dissolving gold in nitrohydrochloric acid, evaporating the solution to dryness, weighing, and dissolving the dry mass in eight times its weight of distilled water. To this solution a weight of pure anhydrous common salt, equalling that of the anhydrous gold chloride, is added, previously dissolved in four parts of water. The mixed solution is then evaporated to dryness, being constantly stirred with a glass rod.

Official Description.—It occurs as an orange-yellow powder; deliquescent when exposed to damp air.

Odor, Taste, and Reaction.—Odorless, having a saline and metallic taste. An aqueous solution (1 in 100) shows a slightly acid reaction.

Solubility.—Gold and Sodium Chloride is very soluble in water; alcohol or ether dissolves the gold chloride leaving the sodium chloride.

Tests for Identity.—A fragment imparts a persistent, intensely yellow color to a non-luminous flame.

An aqueous solution (1 in 100) yields with silver nitrate T.S. a white precipitate insoluble in nitric acid but readily soluble in ammonia water.

Impurities and Tests for Impurities.—*Free Hydrochloric Acid.*—Hold a glass rod, moistened with ammonia water, close to a portion of Gold and Sodium Chloride; no white fumes appear.

Metallic Impurities.—The filtrate from the precipitated gold in the following assay process, after acidulation with hydrochloric acid, is not affected by hydrogen sulphide T.S.

Assay.—Dissolve about 0.5 Gm. of Gold and Sodium Chloride, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed in a stoppered flask, in 10 mils of distilled water in a porcelain dish. Render the solution alkaline by the addition of 10 mils of potassium hydroxide T.S., heat it for five minutes on a water bath, add 25 mils or an excess of solution of hydrogen dioxide and continue the heating for an hour on a water bath, or until the addition of a few drops of solution of hydrogen dioxide produces no further precipitation in the clear liquid. (During the heating on the water bath occasionally replace the liquid lost by evaporation by the addition of hot distilled water.) Wash the precipitate of metallic gold with distilled water slightly acidulated with hydrochloric acid, dry and ignite it. Its weight corresponds to not less than 30 per cent. of the weight of the dried Gold and Sodium Chloride taken.

Uses.—This salt is used internally as an alterative. The dose is from one-twelfth to one-fourth of a grain (0.005 to 0.016 Gm.)

ACIDUM BROMAURICUM. N. F. Bromauric Acid
[Acid. Bromaur.]

It contains $HAuBr_4+5H_2O$ (607.97), corresponding to not less than 32 per cent. of gold, Au. Preserve it in glass-stoppered, amber-colored bottles.

Official Description.—It occurs as dark red-brown, flat, needle-shaped crystals, or as irregular, coarse granular masses. Permanent in the air when pure; when chloride is present the salt is deliquescent.

Odor, Taste, and Reaction.—Odorless, and having a metallic and acid taste. Its aqueous solution is strongly acid to litmus.

Solubility.—It is very soluble in water and in alcohol.

Tests for Identity.—It melts at about 27° C. (80.6° F.).

An aqueous solution yields with silver nitrate T.S. a yellowish-white precipitate, insoluble in nitric acid and but slightly soluble in ammonia water.

Impurities and Tests for Impurities.—Ignite 0.1 Gm. of Bromauric Acid, heat the resulting residue of gold with 5 mils of nitric acid, add 15 mils of distilled water and filter; no weighable residue remains on evaporating the filtrate and igniting.

Chloride.—Dissolve 0.2 Gm. of Bromauric Acid in 10 mils of distilled water, add 16 mils of tenth-normal silver nitrate V.S. and 12 mils of ammonium carbonate T.S., digest the mixture for ten minutes on a water bath, then cool and filter. The filtrate, on supersaturating with nitric acid, does not become more than slightly opalescent.

Bromauric Acid is decomposed on exposure to red heat and leaves a residue of metallic gold equivalent to not less than 32 per cent. of the weight taken.

N. F. Preparation.—Liquor Auri et Arseni Bromidi.

Uses.—It is used in the preparation of the N. F. solution. The dose is one-tenth grain (0.006 Gm.).

QUESTIONS ON GOLD AND PLATINUM

Gold (see page 956.)—What is the Latin name? Give the symbol and atomic weight.
In what form is it official? How is it found?
What are the tests for gold salts?
Platinum—Give the symbol and atomic weight.
What salt of it is official, and for what is it used? How is it found?
What are the tests for platinum salts?
Gold and sodium chloride—What is the composition of this salt?
Give the formulas and equivalents of each of the ingredients.
How much gold is represented?
How is it made?
Describe its appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may its quality be tested? How may free acid and metallic impurities be detected?
For what is it used medicinally?
What is the dose?
Bromauric acid—Give its chemical formula. How much gold is represented?
Describe its appearance, odor, taste, reaction and tests for identity.
What impurities are likely to be present and how detected? What are its uses and the dose?

Condensed Chart of U. S. P. Chemical Substances and their Preparations

Official Name	Chemical Composition	Uses and Doses	Official preparations. The heavy type indicates that the chemical is an active medicinal ingredient
Acetanilidum	C_8H_9ON	Antipyretic; gr. iii–x (0.2–0.65 Gm.)	*N. F. Prep.*—**Pulvis Acetanilidi Compositus**
Acetonum	C_3H_6O	. . . .	*U. S. Prep.*—Collodium Cantharidatum. *N. F. Prep.*—Petroxolinum Iodoformi
Acetphenetidinum	$C_{10}H_{13}O_2N$	Antipyretic; gr. v–x (0.32–0.65 Gm.)	
Acidum Aceticum	$HC_2H_3O_2$	Solvent	*U. S. Prep.*—**Acidum Aceticum Dilutum**, Syrupus Ipecacuanhæ. *N. F. Prep.*—Acetum Aromaticum, Linimentum Terebinthinæ Aceticum, Liquor Alumini Subacetatis, Syrupus Sanguinariæ
Aceticum Dilutum	. . . . . .	Refrigerant; ♏xxx (2 mils)	*U. S. Prep.*—Acetum Scillæ, Liquor Ammonii Acetatis, Liquor Ferri et Ammonii Acetatis. *N. F. Prep.*—Acetum Opii, Liquor Strychninæ Acetatis, Mistura Adstringens, Syrupus Allii
Aceticum Glaciale	$HC_2H_3O_2$	Solvent, caustic	*U. S. Prep.*—Ceratum Cantharidis, Collodium Cantharidatum. *N. F. Prep.*—Liquor Alumini Acetico-Tartratis, Liquor Ferri Acetatis
Benzoicum	$HC_7H_5O_2$	Stimulant; gr. viii (0.5 Gm.)	*U. S. Prep.*—**Tinctura Opii Camphorata.** *N. F. Prep.*—**Nebula Aromatica**
Boricum	H_3BO_3	Antiseptic; gr. viii (0.5 Gm.)	*U. S. Prep.*—**Glyceritum Boroglycerini, Unguentum Acidi Borici.** *N. F. Prep.*—Cataplasma Kaolini, **Liquor Antisepticus, Pulvis Antisepticus, Pulvis Talci Compositus**
Citricum	$H_3C_6H_5O_7 + H_2O$	Refrigerant; gr. xxx (2 Gm.)	*U. S. Prep.*—Caffeina Citrata, Caffeina Citrata Effervescens, Liquor Magnesii Citratis, Liquor Potassii Citratis, Potassii Citras Effervescens, Sodii Phosphas Effervescens, **Syrupus Acidi Citrici**, Syrupus Aurantii, Syrupus Lactucarii. *N. F. Prep.*—Elixir Ferri Pyrophosphatis, Quininæ et Strychninæ, Elixir Zinci Valeratis, Liquor Ammonii Citratis, Liquor Ferri Citratis, Liquor Ferri Salicylatis, Liquor Magnesii Sulphatis Effervescens, Liquor Phosphatum Compositus, Liquor Sodii Citratis, Liquor Sodii Citro-Tartratis Effervescens, Liquor Sodii Phosphatis Compositus, Sal Carolinum Factitium Effervescens, Sal Kissingense Factitium Effervescens, Sal Lithii Citras Effervescens, Sal Potassii Bromidi Effervescens, Sal Potassii Bromidi Effervescens Compositus, Sal Vichyanum Factitium Effervescens, Sal Vichyanum Factitium Effervescens cum Lithio
Gallicum	$HC_7H_5O_5 + H_2O$	Astringent; gr. v–xv (0.32–1 Gm.)	
Hydriodicum Dilutum	HI	Alterative; ♏viii (0.5 mil)	*U.S. Prep.*—**Syrup of Hydriodic Acid**
Hydrobromicum Dilutum	HBr	Hypnotic; ♏xv (1 mil)	*N. F. Prep.*—Elixir Calcii Bromidi
Hydrochloricum	HCl	Tonic, refrigerant	*U. S. Prep.*—**Acidum Hydrochloricum Dilutum, Acidum Nitrohydrochloricum, Acidum Nitrohydrochloricum Dilutum**, Argenti Nitras Fusus, Extractum Ergotæ, Liquor Ferri Chloridi, Liquor Zinci Chloridi, Resina Podophylli, Sulphur Præcipitatum, Tinctura Sanguinariæ. *N. F. Prep.*—Elixir Pepsini, Fluidextractum Cinchonæ Aquosum, Glyceritum Pepsini, Liquor Chlori Compositus, Liquor Ferri Oxychloridi, Liquor Ferri Peptonati, Liquor Ferri Peptonati et Mangani, Liquor Ferri Protochloridi, Liquor Pepsini, Liquor Pepsini Aromaticus, Syrupus Calcii Hydrochlorophosphatis

Official Name	Chemical Composition	Uses and Doses	Official preparations. The heavy type indicates that the chemical is an active medicinal ingredient
Acidum Hydrochloricum Dilutum	. . . . . .	Tonic, refrigerant; ♏xv–xxx (1–2 mils)	*U. S. Prep.*—Liquor Acidi Arsenosi. *N. F. Prep.*—Extractum Conii, Liquor Pepsini Antisepticus
Hydrocyanicum Dilutum	HCN	Sedative, anodyne; ♏1½ (0.1 mil)	
Hypophosphorosum	HPH_2O_2	. . . .	*U. S. Prep.*—**Acidum Hypophosphorosum Dilutum.** *N. F. Prep.*—Elixir Calcii Hypophosphitis, Elixir Cinchonæ Alkaloidorum et Hypophosphitum, Elixir Hypophosphitum, Elixir Hypophosphitum et Ferri, Elixir Sodii Hypophosphitis, Liquor Hypophosphitum, Liquor Hypophosphitum Compositus, Liquor Zinci et Ferri Compositus, Syrupus Calcii et Sodii Hypophosphitum, Syrupus Calcii Hypophosphitis, Syrupus Sodii Hypophosphitis
Hypophosphorosum Dilutum	. . . . . .	Tonic, refrigerant; ♏viii (0.5 mil)	*U. S. Prep.*—Syrupus Ferri Iodidi, Syrupus Hypophosphitum. *N. F. Prep.*—Liquor Ferri Protochloridi, Syrupus Ammonii Hypophosphitis, Syrupus Hypophosphitum Compositus
Lacticum	$HC_3H_5O_3$	Solvent	*U. S. Prep.*—Syrupus Calcii Lactophosphatis. *N. F. Prep.*—Elixir Calcii Lactophosphatis, Elixir Glycerophosphatum Compositum, Elixir Pepsini et Rennini Compositum, Emulsum Olei Morrhuæ cum Calcii Lactophosphate
Nitricum	HNO_3	Too caustic to use internally	*U. S. Prep.*—**Acidum Nitrohydrochloricum, Acidum Nitrohydrochloricum Dilutum,** Liquor Ferri Chloridi, Liquor Ferri Subsulphatis, Liquor Ferri Tersulphatis, Liquor Zinci Chloridi, Magma Bismuthi, Unguentum Hydrargyri Nitratis. *N. F. Prep.*—Glyceritum Bismuthi, Liquor Ferri Nitratis, Liquor Ferri Oxysulphatis, Liquor Hydrargyri Nitratis, Mistura Camphoræ Acida
Nitrohydrochloricum	. . . . . .	Cholagogue; ♏iii (0.2 mil)	
Nitrohydrochloricum Dilutum	. . . . . .	Cholagogue; ♏xv (1 mil)	
Oleicum	$HC_{18}H_{33}O_2$	Vehicle, used externally	*U. S. Prep.*—Oleatum Hydrargyri. *N. F. Prep.*—Oleatum Aconitinæ, Oleatum Atropinæ, Oleatum Cocainæ, Oleatum Quininæ, Oleatum Veratrinæ, Petroxolinum Creosoti, Petroxolinum Guaiacolis, Petroxolinum Hydrargyri, Petroxolinum Iodi, Petroxolinum Iodoformi, Petroxolinum Liquidum, Petroxolinum Spissum, Petroxolinum Sulphuratum
Phenylcinchoninicum	$HC_{16}H_{10}O_2N$	Antirheumatic; gr. viii (0.5 Gm.)	
Phosphoricum	H_3PO_4	. . . .	*U. S. Prep.*—**Acidum Phosphoricum Dilutum,** Syrupus Calcii Lactophosphatis. *N. F. Prep.*—Elixir Calcii et Sodii Glycerophosphatum, Elixir Calcii Lactophosphatis, Elixir Gentianæ Glycerinatum, Liquor Phosphatum Acidus, Liquor Phosphatum Compositus, Syrupus Ferri Lactophosphatis, Syrupus Ferri, Quininæ et Strychninæ Phosphatum
Phosphoricum Dilutum	. . . . . .	Tonic, refrigerant; ♏xxx (2 mils)	
Salicylicum	$HC_7H_5O_3$	Antirheumatic; gr. viii (0.5 Gm.)	*N. F. Prep.*—Collodium Salicylici Compositum, Glycerogelatinum Acidi Salicylici, Mulla Creosoti Salicylata, Mulla Acidi Salicylici, Pasta Zinci, Pulvis Antisepticus, Pulvis Talci Compositus, Stili Acidi Salicylici Dilubiles

Official Name	Chemical Composition	Uses and Doses	Official preparations. The heavy type indicates that the chemical is an active medicinal ingredient
Acidum Stearicum	$HC_{18}H_{35}O_2$	In making glycerin Suppositories	*U. S. Prep.*—Suppositoria Glycerini. *N. F. Prep.*—Linimentum Saponato-Camphoratum
Sulphuricum	H_2SO_4	Too caustic to use internally	*U. S. Prep.*—**Acidum Sulphuricum Aromaticum, Acidum Sulphuricum Dilutum,** Liquor Ferri Subsulphatis, Liquor Ferri Tersulphatis, Spiritus Ætheris Nitrosi. *N. F. Prep.*—Oleum Æthereum
Sulphuricum Aromaticum	. . . . . .	Tonic, astringent; ♏xv (1 mil)	*N. F. Prep.*—Infusum Cinchonæ
Sulphuricum Dilutum	. . . . . .	Tonic refrigerant; ♏xv (1 mil)	*U. S. Prep.*—Ferri Carbonatis Saccharatus, Ferri Sulphas Granulatus. *N. F. Prep.*—Infusum Rosæ, Syrupus Rosæ
Tannicum	. . . . . .	Astringent; gr. viii (0.5 Gm.)	*U. S. Prep.*—**Glyceritum Acidi Tannici, Trochisci Acidi Tannici, Unguentum Acidi Tannici.** *N. F. Prep.*—**Collodium Stypticum,** Syrupus Iodotannicus
Tartaricum	$H_2C_4H_4O_6$	Refrigerant; gr. viii (0.5 Gm.)	*U. S. Prep.*—Acidum Hydriodicum Dilutum, Caffeina Citrata Effervescens, Extractum Aconiti, Extractum Hydrastis, Extractum Physostigmatis, Potassii Citras Effervescens, Pulvis Effervescens Compositus, Sodii Phosphas Effervescens. *N. F. Prep.*—Elixir Pepsini, Bismuthi et Strychninæ, Glyceritum Bismuthi, Liquor Alumini Acetico-Tartratis, Liquor Sodii Citro-Tartratis Effervescens, Sal Carolinum Factitium Effervescens, Sal Kissingense Factitium Effervescens, Sal Lithii Citratis Effervescens, Sal Potassii Bromidi Effervescens, Sal Potassii Bromidi Effervescens Compositum, Sal Vichyanum Factitium Effervescens, Sal Vichyanum Factitium Effervescens cum Lithio
Trichloraceticum	$HC_2Cl_3O_2$	Caustic; external use	
Aconitina	$C_{34}H_{47}O_{11}N$	Cardiac depressant	*N. F. Prep.*—Oleatum Aconitinæ
Æther	$(C_2H_5)_2O$	Anesthetic	*U. S. Prep.*—Collodium, Oleoresina Aspidii, Oleoresina Capsici, Oleoresina Petroselini, Oleoresina Piperis, Oleoresina Zingiberis, Pilulæ Ferri Iodidi, Pilulæ Phosphori, **Spiritus Ætheris.** *N. F. Prep.*—**Mistura Chloroformi et Morphinæ Composita,** Oleoresina Lupulini, Oleum Æthereum, Oleum Phosphoratum, **Spiritus Ætheris Compositus,** Tinctura Ferri Chloridi Ætherea, Tincturæ Æthereæ
Æthylis Carbamas	$C_3H_7O_2N$	Hypnotic; gr. xv (1 Gm.)	
Chloridum	C_2H_5Cl	Local anesthetic; externally	
Æthylmorphinæ Hydrochloridum	$C_{19}H_{23}O_3NHCl + 2H_2O$	Somnifacient; gr. ¼ (0.015 Gm.)	
Alcohol	C_2H_5OH	Used as a solvent	**Diluted Alcohol** and as solvent and preservative in Fluidextracts, Spirits, Tinctures, etc.
Dehydratum	C_2H_5OH	Used as a solvent	*N. F. Prep.*—Liquor Phosphori
Dilutum	. . . . . .	Used as a solvent	Fluidextracts, Tinctures, etc.
Aloinum	. . . . . .	Cathartic; gr. ¼ (0.015 Gm.)	*N. F. Prep.*—**Pilulæ Aloini Compositæ, Pilulæ Aloini, Strychninæ et Belladonnæ, Pilulæ Aloini, Strychninæ et Belladonnæ Compositæ, Pilulæ Laxativæ Compositæ**
Alumen	$AlK(SO_4)_2 + 12H_2O$, Al $NH_4(SO_4)_2 + 12H_2O$	Astringent, emetic; gr. v xxx (0.32–2 Gm.)	*U. S. Prep.*—**Alumen Exsiccatum,** Alumini Hydroxidum. *N. F. Prep.*—Liquor Alumini Acetico-Tartratis, Liquor Cocci

Official Name	Chemical Composition	Uses and Doses	Official preparations. The heavy type indicates that the chemical is an active medicinal ingredient
Alumen Exsiccatum	$AlK(SO_4)_2$, $AlNH_4(SO_4)_2$	Astringent, escharotic; gr. viii (0.5 Gm.)	
Alumini Hydroxidum	$Al(OH)_3$	Astringent	
Ammonii Benzoas	$NH_4C_7H_5O_2$	Stimulant; gr. xv (1 Gm.)	
Bromidum	NH_4Br	Nervine; gr. xv (1 Gm.)	*N. F. Prep.*—**Elixir Ammonii Bromidi, Elixir Trium Bromidorum, Syrupus Bromidorum**
Carbonas	Variable	Stimulant, gr. v (0.32 Gm.)	*U. S. Prep.*—Liquor Ammonii Acetatis, Magma Bismuthi, **Spiritus Ammoniæ Aromaticus.** *N. F. Prep.*—Liquor Ferri Salicylatis, **Mistura Pectoralis, Stokes**
Chloridum	NH_4Cl	Expectorant; gr. v (0.32 Gm.)	*U. S. Prep.*—**Trochisci Ammonii Chloridi.** *N. F. Prep.*—**Mistura Ammonii Chloridi**
Iodidum	NH_4I	Resolvent; gr. v (0.32 Gm.)	
Salicylas	$NH_4C_7H_5O_3$	Antirheumatic; gr. viii (0.5 Gm.)	
Valeras	. . . .	Nervine; gr. viii (0.5 Gm.)	*N. F. Prep.*—**Elixir Ammonii Valeratis**
Amylis Nitris	$C_5H_{11}NO_2$	Cardiac stimulant; ♏iii (0.2 mil)	
Antimonii et Potassii Tartras	$2K(SbO)C_4H_4O_6 + \frac{1}{2}H_2O$	Expectorant, emetic; gr. $^1/_{12}$–½ (0.005–0.03 Gm.)	*U. S. Prep.*—**Mistura Glycyrrhizæ Composita, Syrupus Scillæ Compositus.** *N. F. Prep.*—**Pilulæ ad Prandium, Cole's, Vinum Antimonii**
Antipyrina	$C_{11}H_{12}ON_2$	Antipyretic; gr. v (0.32 Gm.)	
Apomorphinæ Hydrochloridum	$2C_{17}H_{17}O_2.N HCl + H_2O$	Emetic, expectorant; gr. $^1/_{16}$–$^1/_{20}$ (0.003–0.01 Gm.)	
Aqua Ammoniæ	NH_3 in Solution	Stimulant, antacid; ♏xv (1 mil)	*U. S. Prep.*—Extractum Glycyrrhizæ Purum, Fluidextractum Glycyrrhizæ, Fluidextractum Senegæ, **Linimentum Ammoniæ,** Magma Bismuthi, **Spiritus Ammoniæ Aromaticus.** *N. F. Prep.*—Elixir Ammonii Valeratis, Fluidglyceratum Glycyrrhizæ, Linimentum Ammonii Iodidi, **Linimentum Opii Compositum,** Linimentum Saponato-Camphoratum, Liquor Ammonii Citratis, Liquor Carmini, Liquor Ferri Acetatis, Liquor Ferri Citratis, Liquor Ferri Nitratis, Liquor Ferri Oxychloridi, Magma Ferri Hydroxidi, **Spiritus Ammonii Anisatus,** Tinctura Ergotæ Ammoniata
Ammoniæ Fortior	NH_3 in Solution	. . . .	*N. F. Prep.*—Elixir Zinci Valeratis, **Lotio Ammoniacalis Camphorata,** Petroxolinum Iodi, Petroxolinum Liquidum, Petroxolinum Spissum, Tinctura Iodi Decolorata
Destillata	H_2O		
Argenti Nitras	$AgNO_3$	Escharotic, astringent; gr. $^1/_5$ (0.01 Gm.)	*U. S. Prep.*—**Argenti Nitras Fusus**
Nitras Fusus	. . . .	Caustic	
Oxidum	Ag_2O	Tonic; gr. ½–ii (0.03–0.12 Gm.)	
Arseni Iodidum	AsI_3	Alterative; gr. $^1/_{12}$ (0.005 Gm.)	*U. S. Prep.*—**Liquor Arseni et Hydrargyri Iodidi**
Trioxidum	As_2O_3	Alterative; gr. $^1/_{30}$ (0.002 Gm.)	*U. S. Prep.*—**Liquor Acidi Arsenosi, Liquor Potassii Arsenitis.** *N. F. Prep.*—**Liquor Arsenicalis Clemens, Liquor Auri et Arseni Bromidi, Pilulæ Ferri, Quininæ, Strychninæ et Arseni Fortiores, Pilulæ Ferri, Quininæ, Strychninæ et Arseni Mites**

Official Name	Chemical Composition	Uses and Doses	Official preparations. The heavy type indicates that the chemical is an active medicinal ingredient
Atropina	$C_{17}H_{23}O_3N$	Mydriatic; gr. $^{1}/_{120}$–$^{1}/_{160}$ (0.0005–0.0004 Gm.)	*N. F. Prep.*—**Oleatum Atropinæ**
Atropinæ Sulphas	$(C_{17}H_{23}O_3N)_2.H_2SO_4+H_2O$	Mydriatic; gr. $^{1}/_{120}$ (0.0005 Gm.)	
Auri et Sodii Chloridum	$AuCl_3$ and NaCl	Alterative; gr. $^{1}/_{12}$ (0.005 Gm.)	
Benzaldehydum	C_7H_6O	Flavoring; ♏½ (0.03 mil)	
Benzinum Purificatum	. . . . . .	Solvent	*U. S. Prep.*—As a solvent in the removal of the fatty or other objectionable constituents from Fluidextracts, Extracts, and Tinctures
Benzosulphinidum	$C_6H_4.SO_2.CO.NH$	Sweetening; gr. iii (0.2 Gm.)	*U. S. Prep.*—Fluidextractum Cascaræ Sagradæ Aromaticum. *N. F. Prep.*—Oleum Ricini Aromaticum
Betaeucainæ Hydrochloridum	$C_{15}H_{21}O_2NHCl$	Local Anesthetic	
Betanaphthol	$C_{10}H_7OH$	Antiseptic; gr. iv (0.25 Gm.)	*N. F. Prep.*—Liquor Zinci et Alumini Compositus, Liquor Zinci et Ferri Compositus, **Pasta Betanaphtholis**, **Petroxolinum Betanaphtholis**
Bismuthi Betanaphtholas	. . . . . .	Antiseptic; gr. viii (0.5 Gm.)	
et Ammonii Citras	. . . . . .	Nervine; gr. ii (0.12 Gm.)	
Subcarbonas	. . . . . .	Astringent, tonic; gr. viii (0.5 Gm.)	
Subgallas	. . . . . .	Astringent; gr. viii (0.5 Gm.)	
Subnitras	. . . . . .	Astringent, sedative; gr. viii (0.5 Gm.)	*U. S. Prep.*—Magma Bismuthi. *N. F. Prep.*—Glyceritum Bismuthi, Unguentum Resorcinolis Compositum
Subsalicylas	. . . . . .	Intestinal antiseptic; gr. viii (0.5 Gm.)	
Bromoformum	$CHBr_3$	Anesthetic; ♏iii (0.2 mil)	
Caffeina	$C_8H_{10}O_2N_4+H_2O$	Stimulant; gr. iss (0.15 Gm.)	*U. S. Prep.*—**Caffeina Citrata.** *N. F. Prep.*—**Caffeinæ Sodio-Salicylas, Pulvis Acetanilidi Compositus, Sal Potassii Bromidi Effervescens Compositus**
Citrata	. . . . . .	Stimulant; gr. v (0.3 Gm.)	*U. S. Prep.*—**Caffeina Citrata Effervescens**
Citrata Effervescens	. . . . . .	Stimulant; gr. lx (4 Gm.)	
Caffeinæ Sodio-Benzoas	. . . . . .	Diuretic; cardiac stimulant; gr. v (0.32 Gm.), mouth; gr. iii (0.2 Gm.), hypodermic	
Calcii Bromidum	$CaBr_2$	Stimulant, nervine; gr. xv (1 Gm.)	*N. F. Prep.*—**Elixir Calcii Bromidi, Syrupus Bromidorum**
Carbonas Præcipitatus	$CaCO_3$	Antacid, astringent; gr. x–xl (0.65–2.5 Gm.)	*U. S. Prep.*—Syrupus Calcii Lactophosphatis. *N. F. Prep.*—Elixir Calcii Lactophosphatis, Liquor Alumini Subacetatis, Liquor Phosphatum Acidus, Liquor Phosphatum Compositus, Pasta Zinci Mollis, Syrupus Calcii Iodidi, Unguentum Sulphuris Compositum
Chloridum	$CaCl_2$	Hemostatic; gr. viii (0.5 Gm.)	*N. F. Prep.*—**Liquor Hydrastinæ Compositus**
Glycerophosphas	$CaC_3H_7PO_6$	Nerve tonic; gr. iv (0.25 Gm.)	*N. F. Prep.*—**Elixir Calcii et Sodii Glycerophosphatum, Elixir Glycerophosphatum Compositum**

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Calcii Hypophosphis	$Ca(PH_2O_2)_2$	Alterative; gr. viii (0.5 Gm.)	*U. S. Prep.*—**Syrupus Hypophosphitum.** *N. F. Prep.*—**Elixir Calcii Hypophosphitis, Elixir Cinchonæ Alkaloidorum et Hypophosphitum, Elixir Hypophosphitum, Elixir Hypophosphitum et Ferri, Emulsum Olei Morrhuæ cum Hypophosphitibus, Liquor Hypophosphitum, Liquor Hypophosphitum Compositus, Syrupus Calcii et Sodii Hypophosphitum, Syrupus Calcii Hypophosphitis, Syrupus Hypophosphitum Compositus**
Lactas	$Ca(C_3H_5O_3)_2 + 5H_2O$	Alterative; gr. viii (0.5 Gm.)	
Sulphidum Crudum	CaS	Alterative; gr. i (0.065 Gm.)	
Calx	CaO	Escharotic	*U. S. Prep.*—**Liquor Calcis,** Sulphur Præcipitatum. *N. F. Prep.*—Fluidglyceratum Cascaræ Sagradæ Aromaticum, Liquor Calcis Sulphuratæ, **Potassa cum Calce, Soda cum Calce**
Chlorinata	. . . . . .	Disinfectant	*U. S. Prep.*—Liquor Sodæ Chlorinatæ. *N. F. Prep.*—Liquor Potassæ Chlorinatæ
Camphora	$C_{10}H_{16}O$	Stimulant; gr. iss–iii (0.1–0.2 Gm.)	*U. S. Prep.*—**Aqua Camphoræ,** Collodium Flexile, **Linimentum Belladonnæ, Linimentum Chloroformi, Linimentum Camphoræ, Linimentum Saponis, Spiritus Camphoræ, Tinctura Opii Camphorata.** *N. F. Prep.*—**Ceratum Camphoræ, Ceratum Plumbi Subacetatis, Chloral Camphoratum, Emplastrum Fuscum Camphoratum, Linimentum Ammonii Iodidi, Linimentum Opii Compositum, Linimentum Saponato-Camphoratum, Linimentum Sinapis Compositum, Lotio Ammoniacalis Camphorata, Menthol Camphoratum, Mistura Camphoræ Acidi, Mistura Camphoræ Aromatica, Mistura Opii et Chloroformi Composita, Mistura Opii et Rhei Composita, Nebula Aromatica, Nebula Mentholis Composita, Petroxolinum Chloroformi Camphoratum, Petroxolinum Phenolis Camphoratum, Pilulæ Antiperiodicæ, Pilulæ Antiperiodicæ sine Aloe, Pilulæ Opii et Camphoræ, Tinctura Antiperiodica, Tinctura Antiperiodica sine Aloe, Tinctura Kino et Opii Composita, Tinctura Pectoralis, Unguentum Camphoræ**
Monobromata	$C_{10}H_{15}OBr$	Nerve sedative; gr. ii (0.125 Gm.)	
Carbo Ligni	C	Disinfectant, absorbent; gr. xv (1 Gm.)	*N. F. Prep.*—**Trochisci Carbonis Ligni**
Cerii Oxalas	. . . . . .	Sedative, tonic; gr. iii (0.2Gm.)	
Chloralum Hydratum	$C_2HCl_3O + H_2O$	Hypnotic gr. viii (0.5 Gm.)	
Chloroformum	$CHCl_3$	Anesthetic, sedative; ♏v (0.3 mil)	*U. S. Prep.*—**Aqua Chloroformi, Linimentum Chloroformi, Spiritus Chloroformi.** *N. F. Prep.*—Elixir Ammonii Valeratis, Elixir Phosphori, **Linimentum Aconiti et Chloroformi,** Liquor Guttæ Perchæ, Liquor Pancreatini, **Mistura Chloroformi et Morphinæ Composita, Mistura Olei Picis, Misura Opii et Chloroformi Composita, Petroxolinun Chloroformi Camphoratum, Syrupus Pini Strobi Compositus, Syrupus Pini Strobi Compositus cum Morphina,** Trochisci Quininæ Tannatis

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Chromii Trioxidum	CrO_3	Caustic	
Chrysarobinum	. . . .	Alterative; externally; gr. ss (0.03 Gm.)	*U. S. Prep.*—**Unguentum Chrysarobini**
Cinchonidinæ Sulphas	$(C_{19}H_{22}ON_2)_2.H_2SO_4+3H_2O$	Tonic, antipyretic; gr. i–xxx (0.065–2 Gm.)	*N. F. Prep.*—**Elixir Cinchonæ Alkaloidorum** and in other Elixirs containing Cinchona alkaloids in combination with Iron, Bismuth, etc.
Cinchoninæ Sulphas	$(C_{19}H_{22}ON_2)_2.H_2SO_4+2H_2O$	Tonic; gr. i–xxx (0.065–2 Gm.)	*N. F. Prep.*—**Elixir Cinchonæ Alkaloidorum** and in other Elixirs containing Cinchona alkaloids in combination with Iron, Bismuth, etc.
Cocaina	$C_{17}H_{21}O_4N$	Local anesthetic; gr. ¼ (0.015 Gm.)	*N. F. Prep.*—**Oleatum Cocainæ**
Cocainæ Hydrochloridum	$C_{17}H_{21}O_4.NHCl$	Local anesthetic; gr. ¼ (0.015 Gm.)	
Codeina	$C_{18}H_{21}O_3N+H_2O$	Narcotic; gr. ¼–i (0.016–0.065 Gm.)	*N. F. Prep.*—**Elixir Terpini Hydratis et Codeinæ**
Codeinæ Phosphas	$C_{18}H_{21}O_3.NH_3PO_4+2H_2O$	Narcotic; gr. ¼–i (0.016–0.065 Gm.)	
Sulphas	$(C_{18}H_{21}O_3N)_2.H_2SO_4+5H_2O$	Narcotic; gr. ¼–i (0.016–0.065 Gm.)	*N. F. Prep.*—**Syrupus Codeinæ**
Colchicina	$C_{22}H_{25}O_6N$	Antirheumatic; gr. $^{1}/_{120}$ (0.0005 Gm.)	
Cotarninæ Hydrochloridum	$C_{12}H_{14}O_3N.Cl$	Hemostatic, analgesic; gr. i (0.065 Gm.)	
Creosoti Carbonas	. . . .	Antiseptic, antitubercular; gr. xv (1 Gm.)	
Creosotum	. . . .	Antiseptic; ♏iv (0.25 Gm.)	*U. S. Prep.*—**Aqua Creosoti.** *N. F. Prep.*—**Mulla Creosoti Salicylata, Petroxolinum Chloroformi Camphoratum**
Cresol	$C_7H_7.OH$	Disinfectant; ♏i (0.05 mil)	*U. S. Prep.*—**Liquor Cresolis Compositus**
Creta Præparata	$CaCO_3$	Antacid; gr. x–xl (0.65–4 Gm.)	*U. S. Prep.*—Hydrargyrum cum Creta, **Mistura Cretæ, Pulvis Cretæ Compositus.** *N. F. Prep.*—**Pulvis Cretæ Aromaticus**
Cupri Sulphas	$CuSO+5H_2O$	Astringent, emetic; gr. ⅕–iv (0.01–0.25 Gm.)	*N. F. Prep.*—**Liquor Zinci et Ferri Compositus, Mistura Adstringens**
Diacetylmorphina	$C_{21}H_{23}O_5N$	Analgesic; somnifacient; gr. $^{1}/_{20}$ (0.003 Gm.)	*N. F. Prep.*—**Elixir Terpini Hydratis et Diacetylmorphinæ**
Diacetylmorphinæ Hydrochloridum	$C_{21}H_{23}O_5N.HCl$	Analgesic; gr. $^{1}/_{20}$ (0.003 Gm.)	
Elaterinum	. . . .	Hydragogue cathartic; gr. $^{1}/_{20}$ (0.003 Gm.)	*U. S. Prep.*—**Trituratio Elaterini**
Emetinæ Hydrochloridum	$C_{30}H_{44}O_4N_2.2HCl$	Amebicide; gr. ⅓ (0.02 Gm.)	
Eucalyptol	$C_{10}H_{18}O$	Antiseptic, stimulant; ♏v–x (0.3–0.6 mil)	*N. F. Prep.*—**Liquor Antisepticus, Liquor Antisepticus Alkalinus, Liquor Pepsini Antisepticus, Nebula Aromatica, Nebula Eucalyptolis, Nebula Mentholis Composita, Petroxolinum Eucalyptolis, Petroxolinum Iodoformi, Petroxolinum Sulphuratum Compositum, Pulvis Antisepticus**
Eugenol	$C_{10}H_{12}O_2$	Stimulant; ♏iii (0.2 mil)	*N. F. Prep.*—**Mistura Oleo-Balsamica**
Ferri Carbonas Saccharatus	. . . .	Tonic; gr. iv–xx (0.25–1.3 Gm.)	
Chloridum	$FeCl_3$	Hemostatic; gr. i (0.065 Gm.)	
et Ammonii Citras	. . . .	Tonic; gr. iv (0.25 Gm.)	*N. F. Prep.*—**Vinum Carnis et Ferri, Vinum Ferri**
et Quininæ Citras	. . . .	Tonic; gr. iv (0.25 Gm.)	*N. F. Prep.*—**Vinum Ferri Amarum**
Hydroxidum cum Magnesii Oxido	. . . .	Antidote to Arsenic; f℥iv (120 mils)	

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Ferri Phosphas	. . . . . .	Tonic; gr. iv (0.25 Gm.)	*N.F.Prep.*—**Elixir Cinchonæ Alkaloidorum et Ferri, Elixir Ferri Phosphatis, Elixir Gentianæ et Ferri Phosphatis, Liquor Phosphatum Compositus, Syrupus Ferri, Quininæ et Strychninæ Phosphatum**
Sulphas	$FeSO_4 + 7H_2O$	Astringent, tonic; gr. iss (0.1 Gm.)	*U. S. Prep.*—Ferri Carbonas Saccharatus, **Ferri Sulphas Exsiccatus, Ferri Sulphas Granulatus**, Liquor Ferri Subsulphatis, Liquor Ferri Tersulphatis, Massa Ferri Carbonatis. *N. F. Prep.*—Liquor Ferri Oxysulphatis, Liquor Zinci et Ferri Compositus, Mistura Ferri Composita
Sulphas Exsiccatus	$FeSO_4$	Astringent, tonic; gr. i (0.06 Gm.)	*N. F. Prep.*—**Pilulæ Aloes et Ferri, Pilulæ Ferri, Quininæ, Aloes et Nucis Vomicæ**
Sulphas Granulatus	$FeSO_4 + 7H_2O$	Astringent, tonic; gr. iss (0.1 Gm.)	*U. S. Prep.*—Pilulæ Ferri Carbonatis
Ferrum	Fe	. . . .	*U. S. Prep.*—Liquor Ferri Chloridi, Syrupus Ferri Iodidi. *N. F. Prep.*—Liquor Ferri Protochloridi, Syrupus Calcii Iodidi, Syrupus Ferri et Mangani Iodidi
Ferrum Reductum	Fe	Tonic; gr. i (0.065 Gm.)	*U. S. Prep.*—Pilulæ Ferri Iodidi. *N. F. Prep.*—Extractum Ferri Pomatum, **Pilulæ Ferri, Quininæ Strychninæ et Arseni Fortiores, Pilulæ Ferri, Quininæ, Strychninæ et Arseni Mites**
Glucosum	$C_6H_{12}O_6$	Diluent; for extracts	*U. S. Prep.*—Extractum Belladonnæ Foliorum (Pilular), Extractum Cannabis, Extractum Hyoscyami, Extractum Stramonii (Pilular). *N. F. Prep.*—Extractum Cinchonæ, Extractum Conii
Glycerinum	$C_3H_5(OH)_3$	Expectorant, solvent and used externally; ʒi (4 mils)	*U. S. Prep.*—Gelatinum Glycerinatum, Glycerites, Fluidextracts, Liquor Ferri et Ammonii Acetatis, Massa Hydrargyri, Mel Depuratum, Mucilago Tragacanthæ, Pilulæ Ferri Carbonatis, Pilulæ Phosphori, **Suppositoria Glycerini**, Syrupus Calcii Lactophosphatum, Syrupus Hypophosphitum, Syrupus Ipecacuanhæ, Syrupus Lactucarii, Syrupus Pruni Virginianæ, Tinctura Lactucarii, Unguentum Acidi Tannici, Unguentum Iodi. *N. F. Prep.*—Cataplasma Kaolini, Elixir Bismuthi, Elixir Calcii et Sodii Glycerophosphatum, Extractum Conii, Glycerites, Fluidextracts, Fluidglycerates, Suppositoria Boroglycerini, Tinctures, etc.
Glycyrrhizinum Ammoniatum	. . . . . .	Expectorant; gr. iv (0.25 Gm.)	
Guaiacol	$C_7H_8O_2$	Bactericide; ♏viii (0.5 mil)	*N. F. Prep.*—**Petroxolinum Guaiacolis**
Guaiacolis Carbonas	$(C_7H_7O)_2CO_3$	Bactericide; gr. xv (1 Gm.)	
Hexamethylenamina	$C_6H_{12}N_4$	Urinary antiseptic; gr. iv (0.25 Gm.)	
Homatropinæ Hydrobromidum	$C_{16}H_{21}O_3.N$ HBr	Mydriatic; gr. $^1/_{120}$ (0.0005 Gm.)	
Hydrargyri Chloridum Corrosivum	$HgCl_2$	Germicide, alterative; gr. $^1/_{20}$ (0.003 Gm.)	*U. S. Prep.*—**Toxitabellæ Hydrargyri Chloridi Corrosivi.** *N. F. Prep.*—Lotio Flava, **Mulla Hydrargyri Chloridi Corrosivi**
Chloridum Mite	HgCl	Laxative, alterative; gr. ¼–iss (0.015–0.15 Gm.)	*U.S.Prep.*—**Pilulæ Catharticæ Compositæ.** *N. F. Prep.*—Lotio Nigra, **Pilulæ Antimonii Compositæ, Pulvis Hydrargyri Chloridi Mitis et Jalapæ, Trochisci Santonini Compositi**

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Hydrargyri Iodidum Flavum	HgI	Antisyphilitic, alterative; gr. ⅙ (0.01 Gm.)	
Iodidum Rubrum	HgI_2	Antisyphilitic, alterative; gr. 1/20 (0.003 Gm.)	*U. S. Prep.*—**Liquor Arseni et Hydrargyri Iodidi.** *N. F. Prep.*—**Liquor Hydrargyri et Potassi Iodidi**
Oxidum Flavum	HgO	Externally	*U. S. Prep.*—Oleatum Hydrargyri, **Unguentum Hydrargyri Oxidi Flavi**
Oxidum Rubrum	HgO	Externally	*N. F. Prep.*—**Unguentum Hydrargyri Oxidi Rubri,** Liquor Hydrargyri Nitratis
Salicylas	. . . .	Alterative; gr. 1/15 (0.004 Gm.)	
Hydrargyrum	Hg	. . . .	*U. S. Prep.*—**Hydrargyrum cum Cretæ, Massa Hydrargyri, Unguentum Hydrargyri, Unguentum Hydrargyri Dilutum,** Unguentum Hydrargyri Nitratis. *N. F. Prep.*—**Petroxolinum Hydrargyri**
Ammoniatum	$HgNH_2Cl$	Used externally	*U. S. Prep.*—**Unguentum Hydrargyri Ammoniati**
cum Creta	. . . .	Alterative; gr. iv (0.25 Gm.)	
Hydrastina	$C_{21}H_{21}O_6.N$	Alterative; gr. ⅙ (0.01 Gm.)	
Hydrastinæ Hydrochloridum	$C_{21}H_{21}O_6.N$ HCl	Alterative, astringent; gr. ⅙ (0.01 Gm.)	*N. F. Prep.*—**Liquor Hydrastinæ Compositus**
Hydrastininæ Hydrochloridum	$C_{11}H_{11}O_2.N$ HCl	Oxytocic, gr. ¼–½ (0.016–0.03 Gm.)	
Hyoscyaminæ Hydrobromidum	$C_{17}H_{23}O_3N$ HBr	Sedative; gr. 1/200 (0.0003 Gm.)	
Iodoformum	CHI_3	Anesthetic, antiseptic; gr. iv (0.25 Gm.)	*U. S. Prep.*—**Unguentum Iodoformi.** *N. F. Prep.*—**Collodium Iodoformi, Glycerogelatinum Iodoformi, Iodoformum Aromatisatum, Petroxolinum Iodoformi**
Iodum	I	Alterative, stimulant; gr. 1/12 (0.005 Gm.)	*U. S. Prep.*—**Liquor Iodi Compositus,** Pilulæ Ferri Iodidi, Syrupus Ferri Iodidi, **Tinctura Iodi, Unguentum Iodi.** *N. F. Prep.*—**Collodium Iodi,** Linimentum Ammonii Iodidi, Liquor Iodi Phenolatus, **Petroxolinum Iodi, Petroxolinum Iodi Dilutum,** Phenolum Iodatum, Sulphuris Iodidum, Syrupus Calcii Iodidi, Syrupus Ferri et Mangani Iodidi, Syrupus Iodotannicus, **Tinctura Iodi Fortior, Tinctura Iodi Decolorata**
Liquor Acidi Arsenosi	. . . .	Alterative; ♏iii (0.2 mil)	
Ammonii Acetatis	$NH_4C_2H_3O_2$	Diaphoretic; f℥iv (15 mils)	*U. S. Prep.*—**Liquor Ferri et Ammonii Acetatis**
Arseni et Hydrargyri Iodidi	. . . .	Alterative; ♏i½ (0.1 mil)	
Calcis	$Ca(OH)_2$	Antacid; f℥iv (15 mils)	*U. S. Prep.*—Linimentum Calcis. *N. F. Prep.*—Lotio Flava, Lotio Nigra, Pasta Zinci Mollis
Cresolis Compositus	. . . .	Antiseptic, externally	
Ferri Chloridi	$FeCl_3$	Styptic; ♏1½ (0.1 mil)	*U.S. Prep.*—**Tinctura Ferri Chloridi.** *N. F. Prep.*—Ferri Oxidum Saccharatum, **Gossypium Stypticum,** Liquor Ferri Oxychloridi, **Tinctura Ferri Chloridi Ætherea,** Tinctura Ferri Citro-Chloridi
Ferri et Ammonii Acetatis	. . . .	Ferruginous tonic; f℥iv (15 mils)	
Ferri Subsulphatis	. . . .	Styptic; ♏iii (0.2 mil)	
Ferri Tersulphatis	$Fe_2(SO_4)_3$	Styptic; ♏iii (0.2 mil)	*U. S. Prep.*—Ferri Hydroxidum cum Magnesii Oxido. *N. F. Prep.*—Liquor Ferri Acetatis, Liquor Ferri Citratis, Liquor Ferri Nitratis, Magma Ferri Hydroxidi

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Liquor Formaldehydi	$H.CHO$	Antiseptic, preservative	
Hydrogenii Dioxidi	H_2O_2	Antiseptic, deodorant; f ʒi (4 mils)	
Iodi Compositus	. . . . . .	Alterative; ♏iii (0.2 mil)	*N. F. Prep.*—**Liquor Iodi Phenolatus**
Magnesii Citratis	. . . . . .	Cathartic; f ℥xii (350 mils)	
Plumbi Subacetatis	$Pb_2O\ (C_2H_3O_2)_2$	Externally	*U. S. Prep.*—**Liquor Plumbi Subacetatis Dilutus.** *N. F. Prep.*—**Ceratum Plumbi Subacetatis, Mistura Adstringens**
Plumbi Subacetatis Dilutus	. . . . . .	Externally	
Potassii Arsenatis	. . . . . .	Alterative; ♏iii (0.2 mil)	
Potassii Citratis	$K_3C_6H_5O_7$	Refrigerant, diaphoretic; f ʒiv (15 mils)	
Potassii Hydroxidi	KOH	Antacid, antilithic; ♏xv (1 mil)	*N. F. Prep.*—Elixir Catharticæ Compositum, Glyceritum Guaiaci, Mistura Copaibæ, Syrupus Eriodictyi Aromaticus
Sodæ Chlorinatæ	. . . . . .	Deodorant, antiseptic	
Sodii Arsenatis	. . . . . .	Alterative; ♏iii (0.2 mil)	
Sodii Chloridi Physiologicus	. . . . . .	Vehicle for injection	
Sodii Glycerophosphatis	$Na_2C_3H_7PO_6$	Nerve tonic; ♏vi (0.35 mil)	*N. F. Prep.*—Elixir Calcii et Sodii Glycerophosphatum, Elixir Glycerophosphatum Compositum
Sodii Hydroxidi	$NaOH$	Antacid, antilithic; ♏xv (1 mil)	*U. S. Prep.*—Oleum Terebinthinæ Rectificatum
Zinci Chloridi	$ZnCl_2$	Disinfectant	
Lithii Bromidum	$LiBr$	Nervine; gr. xv (1 Gm.)	*N. F. Prep.*—**Elixir Lithii Bromidi, Syrupus Bromidorum**
Carbonas	$LiCO_3$	Diuretic; gr. viii (0.5 Gm.)	*N. F. Prep.*—Elixir Formatum Compositum, Sal Potassii Bromidi Effervescens Compositus
Citras	$Li_3C_6H_5O_7 + 4H_2O$	Diuretic; gr. viii (0.5 Gm.)	*N. F. Prep.*—**Elixir Lithii Citratis, Sal Lithii Citratis Effervescens, Sal Vichyanum Factitium Effervescens cum Lithio**
Magma Bismuthi	. . . . . .	Intestinal antiseptic f ʒi (4 mils)	
Magnesiæ	. . . . . .	Laxative, antacid; f ʒiiss (10 mils)	*U. S. Prep.*—Ferri Hydroxidum cum Magnesii Oxido
Magnesii Carbonas	. . . . . .	Antacid; gr. xlv (3 Gm.). Used as absorbent powder	*U. S. Prep.*—Liquor Magnesii Citratis, Magma Magnesiæ. *N. F. Prep.*—Elixir Formatum Compositum, Liquor Phosphatum Acidus, **Mistura Carminativa,** Syrupus Eriodictyi Aromaticus
Oxidum	MgO	Antacid, laxative; gr. xxx (2 Gm.)	*U.S. Prep.*—**Ferri Hydroxidum cum Magnesii Oxido, Pulvis Rhei Compositus.** *N. F. Prep.*—Massa Copaibæ. Used as a diluent in Powdered Extracts
Oxidum Ponderosum	MgO	Antacid, laxative; gr. xxx (2 Gm.)	*N. F. Prep.*—**Pulvis Rhei et Magnesiæ Anisatus**
Sulphas	$MgSO_4 + 7H_2O$	Cathartic; ℥ss (15 Gm.)	*U. S. Prep.*—**Infusum Sennæ Compositus.** *N. F. Prep.*—**Liquor Magnesii Sulphatis Effervescens, Sal Kissingense Factitium, Sal Kissingense Factitium Effervescens, Sal Vichyanum Factitium, Sal Vichyanum Factitium Effervescens, Sal Vichyanum Factitium Effervescens cum Lithio**
Sulphas Effervescens	. . . . . .	Cathartic; ℥ss (16 Gm.)	
Mangani Dioxidum Præcipitatum	MnO_2	Tonic, alterative; gr. iv (0.25 Gm.)	

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Menthol	$C_{10}H_{19}OH$	Stimulant; gr. i (0.065 Gm.)	*N. F. Prep.*—**Inunctum Mentholis, Inunctum Mentholis Compositum, Liquor Antisepticus, Liquor Pepsini Antisepticus, Menthol Camphoratum, Nebula Aromatica, Nebula Mentholis, Nebula Mentholis Composita, Petroxolinum Mentholis, Pulvis Antisepticus**
Methylis Salicylis	$CH\ C_7H_5O_3$	Antirheumatic; ♏xii (0.75 mil)	*N. F. Prep.*—Cataplasma Kaolini, **Inunctum Mentholis Compositum, Liquor Antisepticus Alkalinus,** Liquor Ferri Salicylatis, **Liquor Pepsini Antisepticus, Nebula Aromatica, Nebula Mentholis Composita, Petroxolinum Methylis Salicylatis.** Used extensively as a flavor in Emulsions, Syrups, Troches, etc.
Methylthioninæ Chloridum	$C_{16}H_{18}N_3ClS$	Bactericide; gr. iiss (0.15 Gm.)	
Morphina	$C_{17}H_{19}O_3N + H_2O$	Sedative; gr. ⅛ (0.008 Gm.)	
Morphinæ Hydrochloridum	$C_{17}H_{19}NO_3.HCl + 3H_2O$	Sedative; gr. ⅛ (0.008 Gm.)	*N. F. Prep.*—**Syrupus Morphinæ et Acaciæ**
Sulphas	$(C_{17}H_{19}NO_3)_2.H_2SO_4 + 5H_2O$	Sedative; gr. ⅛ (0.008 Gm.)	*N. F. Prep.*—**Mistura Chloroformi et Morphinæ Composita, Syrupus Pini Strobi Compositus cum Morphina**
Nitrogenii Monoxidum	N_2O	Anesthetic	
Oxygenium	O	Used in inhalation in treatment of pneumonia, etc.	
Paraffinum	. . . . . .	Used in ointments, etc.	*U. S. Prep.*—Unguentum Acidi Borici
Paraformaldehydum	$(HCHO)_3$	Astringent, antiseptic; gr. viii (0.5 Gm.)	
Paraldehydum	$(CH_3CHO)_3$	Sedative; ♏xxx (2 mils)	
Pelletierinæ Tannas	. . . . . .	Tenicide; gr. iv (0.25 Gm.)	
Petrolatum	. . . . . .	Externally	*U. S. Prep.*—Unguentum Hydrargyri Dilutum, Unguentum Hydrargyri Oxidi Flavi. *N. F. Prep.*—**Emulsum Petrolati,** Pasta Betanaphtholis, Pasta Zinci, Unguentum Hydrargyri Oxidi Rubri, Unguertum Resorcinolis Compositum
Album	. . . . . .	Externally	*U. S. Prep.*—Unguentum Acidi Borici, Unguentum Diachylon, Unguentum Hydrargyri Ammoniati. *N. F. Prep.*—Ceratum Camphoræ, Ceratum Plumbi Subacetatis, Unguentum Zinci Stearatis
Liquidum	. . . . . .	Emollient, laxative; f℥iv (15 mils)	*N.F.Prep.*—**Nebula Aromatica, Nebula Eucalyptolis, Nebula Mentholis Composita, Nebula Thymolis, Pasta Resorcinolis Fortior, Pasta Resorcinolis Mitis.** In all Petroxolins
Phenol	C_6H_5OH	Irritant, disinfectant; gr. i (0.065 Gm.)	*U. S. Prep.*—**Glyceritum Phenolis** (from Liquefied Phenol), **Phenol Liquefactum, Unguentum Phenolis** (from Liquefied Phenol). *N. F. Prep.*—**Aqua Phenolata** (from Liquefied Phenol), **Liquor Iodi Phenolatus** (from Liquefied Phenol), **Liquor Sodii Boratis Compositus** (from Liquefied Phenol), **Nebula Aromatica, Oleum Phenolatum, Petroxolinum Phenolis, Petroxolinum Phenolis Camphoratum, Phenolum Iodatum, Pulvis Antisepticus**
Liquefactum	. . . . . .	Irritant, disinfectant; ♏i (0.05 mil)	*U. S. Prep.*—(See under Phenol)
Phenolphthaleinum	$C_{20}H_{14}O_4$	Laxative; gr. iiss (0.15 Gm.)	*N. F. Prep.*—**Trochisci Phenolphthaleini**

Official Name	Chemical Composition	Uses and Doses	Official preparations. The heavy type indicates that the chemical is an active medicinal ingredient
Phenylis Salicylas	$C_{13}H_{10}O_3$	Internal antiseptic; gr. v (0.3 Gm.)	
Phosphorus	P	Aphrodisiac, stimulant; gr. $^1/_{120}$ (0.0005 Gm.)	*U. S. Prep.*—**Pilulæ Phosphori.** *N. F. Prep.*—**Elixir Phosphori, Liquor Phosphori, Oleum Phosphoratum**
Physostigminæ Salicylas	$C_{15}H_{21}O_2N_3 \cdot C_7H_6O_3$	Myotic; gr. $^1/_{60}$ (0.001 Gm.)	
Pilocarpinæ Hydrochloridum	$C_{11}H_{16}O_2N_2 \cdot HCl$	Diaphoretic; gr. $^1/_{12}$–$^1/_6$ (0.005–0.01 Gm.)	
Nitras	$C_{11}H_{16}O_2N_2 \cdot HNO_3$	Diaphoretic; gr. $^1/_{12}$–$^1/_6$ (0.005–0.01 Gm.)	
Plumbi Acetas	$Pb(C_2H_3O_2)_2 + 3H_2O$	Astringent, sedative; gr. i (0.065 Gm.)	*U. S. Prep.*—Liquor Plumbi Subacetatis. *N. F. Prep.*—Liquor Alumini Acetatis, **Lotio Plumbi et Opii, Pilulæ Opii et Plumbi**
Oxidum	PbO	. . . .	*U. S. Prep.*—Emplastrum Plumbi, Liquor Plumbi Subacetatis
Potassa Sulphurata	. . . . . .	Alterative, parasiticide	
Potassii Acetas	$KC_2H_3O_2$	Diuretic; gr. xv (1 Gm.)	*N. F. Prep.*—**Elixir Buchu et Potassii Acetatis, Elixir Potassii Acetatis, Elixir Potassii Acetatis et Juniperi**
Bicarbonas	$KHCO_3$	Antacid, diuretic; gr. xv (1 Gm.)	*U. S. Prep.*—Liquor Magnesii Citratis, Liquor Potassii Arsenitis, Liquor Potassii Citratis. *N. F. Prep.*—**Liquor Antisepticus Alkalinus,** Liquor Arsenicalis, Clemens, Liquor Magnesii Sulphatis Effervescens, Liquor Phosphatum Compositus
Bitartras	$KHC_4H_4O_6$	Purgative; gr. xxx (2 Gm.)	*U. S. Prep.*—**Pulvis Jalapæ Compositus.** *N. F. Prep.*—Liquor Cocci, Species Laxativæ, **Trochisci Sulphuris et Potassii Bitartratis**
Bromidum	KBr	Nervine; gr. xv (1 Gm.)	*N. F. Prep.*—**Elixir Potassii Bromidi, Elixir Trium Bromidorum, Liquor Bromi, Mistura Chlorali et Potassii Bromidi Composita, Sal Potassii Bromidi Effervescens, Sal Potassii Bromidi Effervescens Compositus, Syrupus Bromidorum**
Carbonas	K_2CO_3	Antacid, gr. xv (1 Gm.)	*U. S. Prep.*—Pilulæ Ferri Carbonatis, Syrupus Rhei, Syrupus Rhei Aromaticus. *N. F. Prep.*—Elixir Formatum, Liquor Cocci, Liquor Potassæ Chlorinatæ, **Mistura Carminativa,** Mistura Ferri Composita, Mistura Opii et Sassafras, Mistura Rhei Alkalina, Sal Vichyanum Factitium, Sal Vichyanum Factitium Effervescens, Sal Vichyanum Factitium Effervescens cum Lithio, Syrupus Asari Compositus, Tinctura Guaiaci Composita, Tinctura Rhei Aquosa, Unguentum Sulphuris Alkalinum, Vinum Aurantii Compositum
Chloras	$KClO_3$	Alterative; gr. iv (0.25 Gm.)	*U. S. Prep.*—**Trochisci Potassii Chloratis.** *N. F. Prep.*—**Gargarisma Guaiaci Compositum,** Liquor Chlori Compositus
Citras	$K_3C_6H_5O_7 + H_2O$	Refrigerant, diaphoretic; gr. xv (1 Gm.)	*U. S. Prep.*—**Potassii Citratis Effervescens.** *N. F. Prep.*—Elixir Cinchonæ Alkaloidorum, Ferri et Calcii Lactophosphatis, Elixir Ferri Lactatis, Elixir Hypophosphitum et Ferri, Liquor Hypophosphitum Compositus, Syrupus Calcii Lactophosphatis et Ferri, Syrupus Ferri Hypophosphitis
Citras Effervescens	. . . . . .	Refrigerant, diaphoretic; gr. lx (4 Gm.)	
et Sodii Tartras	$KNaC_4H_4O_6 + 4H_2O$	Purgative; ʒiss (10 Gm.)	*U. S. Prep.*—**Pulvis Effervescens Compositus**

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Potassii Hydroxidum	KOH	Escharotic	*U. S. Prep.*—Liquor Cresolis Compositus, **Liquor Potassii Hydroxidi**, Sapo Mollis. *N. F. Prep.*—Liquor Picis Liquidæ, **Potassa cum Calce**
Hypophosphis	KPH_2O_2	Alterative; gr. viii (0.5 Gm.)	*U. S. Prep.*—Acidum Hydriodicum Dilutum, **Syrupus Hypophosphitum**. *N. F. Prep.*—**Elixir Hypophosphitum, Elixir Hypophosphitum et Ferri, Emulsum Olei Morrhuæ cum Hypophosphitibus, Liquor Hypophosphitum, Liquor Hypophosphitum Compositus, Syrupus Hypophosphitum Compositus**
Iodidum	KI	Alterative; gr. v (0.3 Gm.)	*U. S. Prep.*—Acidum Hydriodicum Dilutum, Liquor Iodi Compositus, Tinctura Iodi, Unguentum Iodi. *N.F. Prep.*—**Elixir Corydalis Compositum, Elixir Sodii Salicylatis Compositum, Liquor Hydrargyri et Potassii Iodidi**, Tinctura Iodi Fortior, **Unguentum Potassii Iodidi**
Nitras	KNO_3	Diuretic; gr. viii (0.5 Gm.)	*N. F. Prep.*—**Charta Potassii Nitratis**
Permanganas	$KMnO_4$	Disinfectant, emmenagogue; gr. i (0.065 Gm.)	
Pyrogallol	$C_6H_6O_3$	Externally	
Pyroxylinum	$C_{12}H_{16}(ONO_2)_4O_6$	. . . .	*U. S. Prep.*—Collodium
Quinina	$C_{20}H_{24}O_2N_2 + 3H_2O$	Tonic, febrifuge; gr. iss–xv (0.1–1 Gm.)	*N. F. Prep.*—Elixir Formatum Compositum, Oleatum Quininæ, Syrupus Ferri, Quininæ et Strychninæ Phosphatum, Syrupus Hypophosphitum Compositus
Quininæ Bisulphas	$C_{20}H_{24}O_2N_2.H_2SO_4 + 7H_2O$	Tonic, febrifuge; gr. iss–xv (0.1 1 Gm.)	*N.F. Prep.*—**Tinctura Antiperiodica, Tinctura Antiperiodica sine Aloe**
Dihydrochloridum	$C_{20}H_{24}O_2N_2.2HCl$	Tonic; iss–xv (0.1–1 Gm.)	
et Ureæ Hydrochloridum	$C_{20}H_{24}O_2N_2.HCl.CO(NH_2)_2.HCl + 5H_2O$	Local anesthetic; gr. xv (1 Gm.) daily	
Hydrobromidum	$C_{20}H_{24}O_2N_2.HBr + H_2O$	Tonic, febrifuge; gr. iss–xv (0.1–1 Gm.)	
Hydrochloridum	$C_{20}N_{24}O_2N_2.HCl + 2H_2O$	Tonic, febrifuge; gr. iss–xv (0.1 1 Gm.)	*N. F. Prep.*—**Elixir Ferri, Quininæ et Strychninæ**, Syrupus Phosphatum cum Quinina et Strychnina
Salicylas	$C_{20}H_{24}O_2N_2.C_7H_6O_3 + H_2O$	Tonic, febrifuge; gr. iss–xv (0.1–1 Gm.)	
Sulphas	$(C_{20}H_{24}O_2N_2)_2.H_2SO_4 + 7H_2O$	Tonic, febrifuge; gr. iss–xv (0.1–1 Gm.)	*N. F. Prep.*—**Elixir Cinchonæ Alkaloidorum** and in other Elixirs containing Cinchona Alkaloids in combination with Iron, Bismuth, etc., **Elixir Ferri Pyrophosphatis, Quininæ et Strychninæ, Pilulæ Antiperiodicæ, Pilulæ Ferri, Quininæ, Aloes et Nucis Vomicæ, Pilulæ Ferri, Quininæ, Strychninæ et Arseni Fortiores, Pilulæ Ferri, Quininæ, Strychninæ et Arseni Mites, Pilulæ Opii, Digitalis et Quininæ**
Tannas	. . . .	Antimalarial; gr. iii (0.2 Gm.)	*N. F. Prep.*—**Trochisci Quininæ Tannatis**
Resorcinol	$C_6H_6O_2$	Antipyretic, antiseptic; gr. ii (0.13 Gm.)	*N. F. Prep.*—**Pasta Resorcinolis Fortis, Pasta Resorcinolis Mitis, Unguentum Resorcinolis Compositum**
Saccharum	$C_{12}O_{22}O_{11}$	Demulcent, lenitive	*U. S. Prep.*—Used as as sweetening agent and a preservative in Emulsions, Pills, Syrups, Troches, etc.
Lactis	$C_{12}H_{22}O_{11} + H_2O$	. . . .	*U. S. Prep.*—Ferri Carbonatis Saccharatus, Pulvis Ipecacuanhæ et Opii, Trituratio Elaterini, Pepsinum Saccharatum

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Salicinum	$C_{13}H_{18}O_7$	Tonic, febrifuge; gr. xv (1 Gm.)	
Santoninum	$C_{15}H_{18}O_3$	Anthelmintic; gr. i (0.065 Gm.)	*N. F. Prep.*—**Trochisci Santonini, Trochisci Santonini Compositi**
Sapo	. . . . . .	Antacid	*U. S. Prep.*—Extractum Colocynthidis Compositum, Linimentum Chloroformi, Linimentum Saponis, Pilulæ Aloes, Pilulæ Asafœtidæ. *N. F. Prep.*—Emplastrum Saponis, Pilulæ ad Prandium (Hall's), Pilulæ Aloes et Asafœtidæ, Pilulæ Rhei
Mollis	. . . . . .	Externally	*U. S. Prep.*—**Linimentum Saponis Mollis.** *N. F. Prep.*—**Linimentum Saponis Mollis Compositum**, Pasta Betanaphtholis, **Unguentum Sulphuris Compositum**
Scopolaminæ Hydrobromidum	$C_{17}H_{21}O_4N.HBr+3H_2O$	Sedative; gr. $^1/_{200}$ (0.0003 Gm.)	
Sodii Acetas	$NaC_2H_3O_2+3H_2O$	Diuretic; gr. xv (1 Gm.)	
Arsenas	$Na_2HAsO_4+7H_2O$	Alterative; gr. $^1/_{12}$ (0.005 Gm.)	*U. S. Prep.*—**Sodii Arsenas Exsiccatus**
Arsenas Exsiccatus	Na_2HAsO_4	Alterative; gr. $^1/_{20}$ (0.003 Gm.)	*U. S. Prep.*—**Liquor Sodii Arsenatis.** *N. F. Prep.*—**Liquor Sodii Arsenatis** (Pearson)
Benzoas	$NaC_7H_5O_2$	Antirheumatic; gr. xv (1 Gm.)	*N. F. Prep.*—**Liquor Antisepticus, Liquor Antisepticus Alkalinus, Sodii Boro-Benzoas**
Benzosulphinidum	$NaC_7H_4O_3NS+2H_2O$	Sweetening agent; dose, gr. iii (0.2 Gm.)	*N. F. Prep.*—**Trochisci Quininæ Tannatis**
Bicarbonas	$NaHCO_3$	Antacid; gr. xv (1 Gm.)	*U. S. Prep.*—Ferri Carbonatis Saccharatus, Pulvis Effervescens Compositus, **Trochisci Sodii Bicarbonatis.** *N. F. Prep.*—Glyceritum Bismuthi, Liquor Pancreatini, Liquor Phosphatum Compositus, **Liquor Sodæ et Menthæ,** Liquor Sodii Boratus Compositus, Liquor Sodii Citratis, Liquor Sodii Citro-Tartratis Effervescens, **Mistura Rhei Composita, Pulvis Acetanilidi Compositus,** Pulvis Pancreatini Compositus and in all of the Effervescent Salts
Boras	$Na_2B_4O_7+10H_2O$	Antacid, diuretic; gr. xii (0.75 Gm.)	*U. S. Prep.*—Unguentum Aquæ Rosæ. *N. F. Prep.*—**Liquor Antisepticus Alkalinus, Liquor Sodii Boratus Compositus, Mel Rosæ et Sodii Boratis, Mel Sodii Boratis, Sodii Boro-Benzoas**
Bromidum	NaBr	Nervine; gr. xv (1 Gm.)	*N. F. Prep.*—**Elixir Sodii Bromidi, Elixir Trium Bromidorum, Syrupus Bromidorum**
Cacodylas	$Na(CH_3)_2AsO_2$	Alterative, hematinic; gr. i (0.065 Gm.)	
Carbonas Monohydratus	$Na_2CO_3+H_2O$	Antacid; gr. iv (0.25 Gm.)	*U. S. Prep.*—Alumini Hydroxidum, Liquor Sodæ Chlorinatæ, Massa Ferri Carbonatis, Suppositoria Glycerini. *N. F. Prep.*—Elixir Formatum, Elixir Formatum Compositum, Ferri Oxidum Saccharatum, Linimentum Saponato-Camphoratum, Liquor Alumini Acetico-Tartratis
Chloridum	NaCl	Emetic; ʒss (15 Gm.)	*U. S. Prep.*—**Liquor Sodii Chloridi Physiologicus.** *N. F. Prep.*—Liquor Pancreatini, Lotio Ammoniacalis Camphorata, Sal Carolinum Factitium, Sal Carolinum Factitium Effervescens, Sal Kissingense Factitium, Sal Kissingense Factitium Effervescens, Sal Vichyanum Factitium, Sal Vichyanum Factitium Effervescens, Sal Vichyanum Factitium Effervescens cum Lithio

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Sodii Citras	$Na_3C_6H_5O_7 + 2H_2O$	Refrigerant, diaphoretic; gr. xv (1 Gm.)	*N. F. Prep.*—Elixir Gentianæ, Liquor Ferri Albuminati, Liquor Ferri Peptonati, Liquor Ferri Peptonati et Mangani, Syrupus Hypophosphitum Compositus, Tinctura Ferri Citro-Chloridi
Cyanidum	$NaCN$	Sedative; nerve depressant	
Glycerophosphas	$Na_2C_3H_7PO_6$	Tonic; gr. iv (0.25 Gm.)	
Hydroxidum	$NaOH$	Escharotic	*U. S. Prep.*—**Liquor Sodii Hydroxidi**, Magma Magnesiæ. *N. F. Prep.*—**Soda cum Calce**
Hypophosphis	$NaPH_2O_2 + H_2O$	Alterative; gr. xv (1 Gm.)	*U. S. Prep.*—**Syrupus Hypophosphitum.** *N. F. Prep.*—**Elixir Cinchonæ Alkaloidorum et Hypophosphitum, Elixir Hypophosphitum, Elixir Hypophosphitum et Ferri, Elixir Sodii Hypophosphitis, Emulsum Olei Morrhuæ cum Hypophosphitibus, Liquor Hypophosphitum, Liquor Hypophosphitum Compositum, Syrupus Calcii et Sodii Hypophosphitum, Syrupus Hypophosphitum Compositus, Syrupus Sodii Hypophosphitis**
Indigotindisulphonas	$C_{16}H_8O_2N_2(SO_3Na)_2$	Coloring	*U. S. Prep.*—Toxitabellæ Hydrargyri Chloridi Corrosivi
Iodidum	NaI	Alterative; gr. v (0.3 Gm.)	*N. F. Prep.*—Syrupus Ferri et Mangani Iodidi
Nitris	$NaNO_2$	. . . .	*U. S. Prep.*—Spiritus Ætheris Nitrosi
Perboras	$NaBO_3 + 4H_2O$	Antiseptic, deodorant; gr. i (0.065 Gm.)	
Phenolsulphonas	$NaC_6H_5O_4S + 2H_2O$	Antiferment; gr. iv (0.25 Gm.)	
Phosphas	$Na_2HPO_4 + 12H_2O$	Purgative; ʒi (4 Gm.)	*U. S. Prep.*—**Sodii Phosphas Exsiccatus.** *N. F. Prep.*—**Liquor Sodii Phosphatis Compositus**
Phosphas Effervescens	. . . . . .	Purgative; ʒiiss (10 Gm.)	
Phosphas Exsiccatus	Na_2HPO_4	Purgative; gr. xxx (2 Gm.)	*U. S. Prep.*—**Sodii Phosphas Effervescens**
Salicylas	$NaC_7H_5O_3$	Antirheumatic; gr. xv (1 Gm.)	*N. F. Prep.*—**Caffeinæ Sodio-Salicylas, Elixir Sodii Salicylatis, Elixir Sodii Salicylatis Compositum, Liquor Antisepticus, Liquor Ferri Salicylatis**
Sulphas	$Na_2SO_4 + 10H_2O$	Cathartic; ʒiv (15 Gm.)	*N. F. Prep.*—Sal Carolinum Factitium, Sal Carolinum Factitium Effervescens
Sulphis Exsiccatus	Na_2SO_3	Antiferment; gr. xv (1 Gm.)	
Thiosulphas	$Na_2S_2O_3 + 5H_2O$	Alterative; gr. xv (1 Gm.)	*N. F. Prep.*—**Tinctura Iodi Decolorata, Unguentum Potassii Iodidi**
Sparteinæ Sulphas	$C_{15}H_{26}N_2.H_2SO_4 + 5H_2O$	Cardiac stimulant; gr. ⅙ (0.01 Gm.)	
Spiritus Ætheris Nitrosi	$C_2H_5NO_2$	Diuretic, diaphoretic; ♏xxx (2 mils)	*U. S. Prep.*—**Mistura Glycyrrhizæ Composita, Mistura Copaibæ, Mistura Copaibæ et Opii**
Ammoniæ Aromaticus	. . . . . .	Stimulant; ♏xxx (2 mils)	*U. S. Prep.*—**Tinctura Guaiaci Ammoniata, Tinctura Valerianæ Ammoniata.** *N. F. Prep.*—**Liquor Sodæ et Menthæ,** Tinctura Kino et Opii Composita
Glycerylis Nitratis	$C_3H_5(NO_3)_3$	Cardiac stimulant; ♏i (0.05 mil)	
Strontii Bromidum	$SrBr_2 + 6H_2O$	Nervine; gr. xv (1 Gm.)	
Iodidum	$SrI_2 + 6H_2O$	Alterative; gr. v (0.3 Gm.)	
Salicylas	$Sr(C_7H_5O_3)_2 + 2H_2O$	Antirheumatic; gr. xv (1 Gm.)	
Strophanthinum	. . . . . .	Cardiac stimulant; gr. $^1/_{80}$–$^1/_{60}$ (0.00075–0.001 Gm.)	

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Strychnina	$C_{21}H_{22}O_2N_2$	Stimulant, tonic; gr. $^{1}/_{40}$ (0.0015 Gm.)	*N. F. Prep.*—**Elixir Ferri Pyrophosphatis, Quininæ et Strychninæ, Elixir Pepsini, Bismuthi et Strychninæ, Liquor Hypophosphitum Compositus, Liquor Strychninæ Acetatis, Pilulæ Aloini, Strychninæ et Belladonnæ, Pilulæ Aloini, Strychninæ et Belladonnæ Compositæ, Pilulæ Antidyspepticæ, Pilulæ Ferri, Quininæ, Strychninæ et Arseni Fortiores, Pilulæ Ferri, Quininæ, Strychninæ et Arseni Mites, Pilulæ Laxativæ Compositæ, Syrupus Ferri, Quininæ et Strychninæ Phosphatum, Syrupus Hypophosphitum Compositus**
Strychninæ Nitras	$C_{21}H_{22}O_2N_2.HNO_3$	Stimulant, tonic; gr. $^{1}/_{40}$ (0.0015 Gm.)	*N. F. Prep.*—**Syrupus Phosphatum cum Quininæ et Strychninæ**
Sulphas	$(C_{21}H_{22}O_2N_2)_2.H_2SO_4+5H_2O$	Stimulant, tonic; gr. $^{1}/_{40}$ (0.0015 Gm.)	*N. F. Prep.*—**Elixir Cinchonæ Alkaloidorum, Ferri, Bismuthi et Strychninæ, Elixir Cinchonæ Alkaloidorum, Ferri et Strychninæ, Elixir Ferri, Quininæ et Strychninæ, Elixir Quininæ Valeratis et Strychninæ**
Sulphonethylmethanum	$C_8H_{18}S_2O_4$	Hypnotic; gr. xii (0.75 Gm.)	
Sulphonmethanum	$C_7H_{16}S_2O_4$	Hypnotic; gr. xii (0.75 Gm.)	
Sulphur Lotum	S	Diaphoretic, resolvent; ʒi (4 Gm.)	*U. S. Prep.*—**Pulvis Glycyrrhizæ Compositus**, Sulphuris Iodidum, **Trochisci Sulphuris et Potassii Bitartratis**
Præcipitatum	S	Diaphoretic, resolvent; ʒi (4 Gm.)	*N. F. Prep.*—**Pasta Betanaphtholis, Pasta Zinci Sulphurata**
Sublimatum	S	Diaphoretic, resolvent; ʒi (4 Gm.)	*U. S. Prep.*—Sulphur Lotum, Sulphur Præcipitatum, **Unguentum Sulphuris.** *N. F. Prep.*—Liquor Calcis Sulphuratæ, Petroxolinum Sulphuratum, Petroxolinum Sulphuratum Compositum, **Unguentum Sulphuris Alkalinum, Unguentum Sulphuris Compositum**
Syrupus Acidi Hydriodici	HI	Alterative; fʒi (4 mils)	
Calcii Lactophosphatis	. . . . . .	Alterative; fʒiiss (10 mils)	*N. F. Prep.*—**Elixir Cinchonæ Alkaloidorum, Ferri et Calcii Lactophosphatis, Syrupus Calcii Lactophosphatis et Ferri**
Ferri Iodidi	FeI_2	Alterative; ♏xv (1 mil)	
Talcum Purificatum	. . . . . .	Filtering medium	*U. S. Prep.*—Pulvis Talci Compositus, also used as a filtering and distributing medium in Waters, Elixirs, etc.
Terebenum	. . . . . .	Expectorant; ♏iv (0.25 mil)	
Terpini Hydras	$C_{10}H_{20}O_2+H_2O$	Expectorant; gr. iv (0.25 Gm.)	*N. F. Prep.*—**Elixir Terpini Hydratis, Elixir Terpini Hydratis et Diacetylmorphinæ, Elixir Terpini Hydratis et Codeinæ**
Terra Silicea Purificata	SiO_2	Filtering medium	*U. S. Prep.*—Filtering medium in Aromatic Waters. *N. F. Prep.*—Pasta Zinci Sulphurata
Theobrominæ Sodio-Salicylas	. . . . . .	Diuretic; gr. xv (1 Gm.)	
Theophyllina	$C_7H_8O_2N_4+H_2O$	Stimulant, diuretic; gr. iv (0.25 Gm.)	
Thymol	$C_{10}H_{14}O$	Antiseptic; gr. ii–xv (0.13–1 Gm.)	*N. F. Prep.*—**Cataplasma Kaolini, Liquor Antisepticus, Liquor Antisepticus Alkalinus, Nebula Aromatica, Nebula Thymolis, Petroxolinum Sulphuratum Compositum, Pulvis Antisepticus**
Thymolis Iodidum	$C_{20}H_{24}O_2I_2$	Antiseptic, externally	

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Tinctura Ferri Chloridi	$FeCl_3$	Tonic; ♏viii (0.5 mil)	*U. S. Prep.*—Liquor Ferri et Ammonii Acetatis
Iodi	I	Alterative, irritant; ♏1½ (0.1 mil)	
Toxitabellæ Hydrargyri Chloridi Corrosivi	$HgCl_2$	Antiseptic	
Trinitrophenol	$C_6H_3O_7N_3$	Antiperiodic, anthelmintic; gr. ½ (0.03 Gm.)	
Unguentum Hydrargyri Nitratis	. . . . . .	Stimulant, parasiticide	
Uranii Nitras	$UO_2(NO_3)_2 + 6H_2O$	Antidiabetic; gr. ⅙ (0.01 Gm.) (Use with caution)	
Vanillinum	$C_8H_8O_3$	Flavor; gr. ½ (0.03 Gm.)	*N. F. Prep.*—Used as a flavor in the following: Elixir Amygdalæ Compositum, Elixir Vanillini Compositum, Liquor Ferri Peptonati, Liquor Ferri Peptonati et Mangani, Oleum Ricini Aromaticum, Spiritus Vanillini Compositus, Trochisci Carbonis Ligni, Trochisci Phenolphthaleini, Trochisci Quininæ Tannatis, Trochisci Santonini, Trochisci Santonini Compositi
Veratrina	. . . . . .	Externally	*N. F. Prep.*—**Oleatum Veratrinæ, Unguentum Veratrinæ**
Zinci Acetas	$Zn(C_2H_3O_2)_2 + 2H_2O$	Astringent; gr. ii (0.13 Gm.)	
Carbonas Præcipitatus	. . . . . .	Externally	*U. S. Prep.*—Liquor Zinci Chloridi
Chloridum	$ZnCl_2$	Escharotic	
Oxidum	ZnO	Externally	*U. S. Prep.*—**Unguentum Zinci Oxidi.** *N. F. Prep.*—**Glycerogelatinum Zinci Durum, Glycerogelatinum Zinci Molle, Mulla Zinci, Pasta Resorcinolis Fortis, Pasta Resorcinolis Mitis, Pasta Zinci, Pasta Zinci Mollis, Pasta Zinci Sulphurata, Unguentum Picis Compositum, Unguentum Resorcinolis Compositum**
Phenolsulphonas	$Zn(C_6H_5O_4S)_2 + 8H_2O$	Externally, antiseptic, astringent; gr. ii (0.13 Gm.)	
Stearas	. . . . . .	Externally	*N. F. Prep.*—**Unguentum Zinci Stearatis**
Sulphas	$ZnSO_4 + 7H_2O$	Astringent; gr. xv (1 Gm.)	*N. F. Prep.*—Liquor Zinci et Alumini Compositus, Liquor Zinci et Ferri Compositus, **Mistura Adstringens, Pulvis Antisepticus**
Valeras	$Zn(C_5H_9O_2)_2 + 2H_2O$	Antispasmodic; gr. ii (0.13 Gm.)	*N. F. Prep.*—**Elixir Zinci Valeratis**
Zincum	Zn	. . . .	*U. S. Prep.*—Liquor Zinci Chloridi

Condensed Chart of N. F. Chemical Substances and Their Preparations

Official Name	Chemical Composition	Uses and Doses	Official preparations. The heavy type indicates that the chemical is an active medicinal ingredient
Acidum Bromauricum	$HAuB_4 + 5H_2O$	Anodyne; nervine; gr. 1/10 (0.006 Gm.)	*N. F. Prep.*—**Liquor Auri et Arseni Bromidi**
Formicum	$HCOOH$	Tonic; antirheumatic; ♏v (0.3 mil)	*N. F. Prep.*—Elixir Formatum, Elixir Formatum Compositum, Spiritus Acidi Formici
Æther Aceticus	$C_4H_8O_2$	Stimulant, carminative; ♏xv (1 mil)	*N. F. Prep.*—Elixir Formatum Compositum, Elixir Gentianæ Glycerinatum, Liquor Ferri Peptonati, Liquor Ferri Peptonati et Mangani, Spiritus Odoratus
Alumini Chloridum	$AlCl_3 + 6H_2O$	Antiseptic, astringent; gr. v (0.3 Gm.)	*N. F. Prep.*—**Liquor Hydrastinæ Compositus**
Sulphas	$Al_2(SO_4)_3 + 16H_2O$	Astringent; antiseptic	*N. F. Prep.*—Liquor Alumini Acetatis, Liquor Alumini Subacetatis, Liquor Zinci et Alumini Compositus
Ammonii Hypophosphis	$NH_4PH_2O_2$	Tonic, reconstructive; gr. iii (0.2 Gm.)	*N. F. Prep.*—**Syrupus Ammonii Hypophosphitis**
Phosphas	$(NH_4)_2HPO_4$	Diuretic; gr. v (0.3 Gm.)	*N. F. Prep.*—**Liquor Phosphatum Compositus**
Anethol	$C_6H_4.C_3H_5.OCH_3$	Expectorant, carminative; ♏iii (0.2 mil)	*N. F. Prep.*—**Elixir Anisi**, Elixir Cardamomi Compositum, Pulvis Rhei et Magnesiæ Anisatus, Spiritus Ammoniæ Anisatus, Spiritus Cardamomi Compositus
Antimonii Oxidum	Sb_2O_3	Expectorant; emetic; gr. i (0.065 Gm.)	*N. F. Prep.*—**Pulvis Antimonialis**
Antimonium Sulphuratum	Sb_2S_3	Diaphoretic, alterative; gr. 1/15 (0.004 Gm.)	*N. F. Prep.*—**Pilulæ Antimonii Compositæ**
Bromum	Br	Antiseptic, caustic, disinfectant	*N. F. Prep.*—**Liquor Arsenicalis**, (Clemens), **Liquor Auri et Arseni Bromidi, Liquor Bromi**
Calamina Præparata	. . . . . .	Astringent, exsiccant	*N. F. Prep.*—**Unguentum Calaminæ**
Calcii Lactophosphas	. . . . . .	Tonic, nutrient; gr. viii (0.5 Gm.)	*N. F. Prep.*—**Emulsum Olei Morrhuæ cum Calcii Lactophosphate**
Phosphas Præcipitatus	$Ca_3(PO_4)_2$	Bone nutrient; gr. xv (1 Gm.)	*N. F. Prep.*—**Emulsum Olei Morrhuæ cum Calcii Phosphate, Pulvis Antimonialis,** Syrupus Calcii Hydrochlorophosphatis
Caramel	. . . . . .	Coloring agent	*N. F. Prep.*—Used as a coloring agent in the following: Elixir Ammonii Valeratis, Elixir Cinchonæ Alkaloidorum, Elixir Pepsini et Bismuthi, Elixir Quininæ Valeratis et Strychninæ, Elixir Strychninæ Valeratis, Elixir Vanillini Compositum, Syrupus Bromidorum, Tinctura Caramellis, Tinctura Pectoralis, Tinctura Persionis Composita
Carminum	. . . . . .	Coloring agent	*N. F. Prep.*—As a color in Liquor Carmini, Trochisci Phenolphthaleini
Coumarinum	$C_6H_4(CH)_2OCO$	Flavoring agent	*N. F. Prep.*—Iodoformum Aromatisatum, Oleum Ricini Aromaticum
Dextrinum Album	. . . . . .	Nutrient	*N. F. Prep.*—Pasta Dextrinata, Stili Acidi Salicylici Dilubiles
Ferri Glycerophosphas	$Fe_2(C_3H_7O_6P)_3$	Hematinic; gr. iii (0.2 Gm.)	*N. F. Prep.*—**Elixir Glycerophosphatum Compositum**
Hypophosphis	$Fe(PH_2O_2)_3$	Chalybeate; gr. iii (0.2 Gm.)	*N. F. Prep.*—**Elixir Ferri Hypophosphitis, Elixir Hypophosphitum et Ferri, Liquor Ferri Hypophosphitis, Liquor Hypophosphitum Compositus, Syrupus Ferri Hypophosphitis, Syrupus Hypophosphitum Compositus**
Lactas	$Fe(C_3H_5O_3)_2 + 3H_2O$	Hematinic, tonic gr. v (0.32 Gm.)	*N. F. Prep.*—**Elixir Ferri Lactatis, Syrupus Calcii Lactophosphatis et Ferri, Syrupus Ferri Lactophosphatis**

specific gravity 1.840 and one part of water (*both by measure*), and the whole *cooled to* 15° C. (59° F.), the valuable product known as *parchment paper* is produced, amyloids being formed. The strips of paper should be well washed by passing them through a dilute solution of ammonia and water. This paper is useful as a dialyzing medium; it forms, when perfect, the best septum (see Dialysis). When cellulose is treated with nitric acid, pyroxylin, or gun cotton, is produced.

GOSSYPIUM PURIFICATUM. U. S. Purified Cotton

[Gossyp. Purif.—Absorbent Cotton]

The hairs of the seed from one or more of the cultivated varieties of *Gossypium herbaceum* Linné (Fam. *Malvaceæ*), freed from adhering impurities and linters and deprived of fatty matter.

Purified cotton wool is cellulose in one of its purest forms. For a long time one of the most important uses of this valuable staple, that of an absorbent and substitute for sponge, was neglected, because a trace of fatty matter was permitted to remain, which coated the filaments and prevented them from absorbing liquids freely and uniformly. The so-called absorbent cotton of commerce was introduced, and it soon became an important product. This is cotton freed from the trace of fatty matter by boiling it in a weak alkaline solution, rinsing it in a weak solution of chlorinated lime to whiten it, dipping it into a very dilute solution of hydrochloric acid, and then thoroughly rinsing it with pure water; the cotton, having been thoroughly dried, is then carded. The loss is about 10 per cent.

Official Description.—White, soft, fine filaments, appearing under the microscope as hollow, flattened and twisted bands, spirally striate, and slightly thickened at the edges.

Odor and Taste.—Inodorous and almost tasteless.

Solubility.—Insoluble in ordinary solvents, but soluble in an ammonia solution of cupric oxide.

Impurities and Tests for Impurities.—When Purified Cotton, previously compressed in the hand, is thrown on the surface of cold water, it readily absorbs the latter and sinks.

Incinerate 5 Gm. of Purified Cotton; not more than 0.2 per cent. of ash remains.

Alkali or Acid.—Thoroughly saturate about 10 Gm. of Purified Cotton with 100 mils of distilled water, then with the aid of a glass rod press out two portions of the water, 25 mils each, into white porcelain dishes. Add to one portion 3 drops of phenolphthalein T.S. and to the other portion 1 drop of methyl orange T.S.; no pink color develops in either portion.

Fatty Matter.—Extract 5 Gm. of Purified Cotton, tightly packed in a narrow percolator, with ether, until the percolate measures 20 mils, and evaporate this to dryness; the residue does not exceed 0.6 per cent.

Dyes.—Extract 10 Gm. of Purified Cotton, in a narrow percolator, with alcohol, until the percolate measures 100 mils. When observed downward through a column 20 cm. in depth, the percolate may show a yellowish color, but no blue or green tint.

Resins and Soap.—On evaporating this percolate to dryness, the weight of the residue does not exceed 0.5 per cent.

N. F. Preparation.—Gossypium Stypticum.

Uses.—Cellulose is employed in the form of filtering paper, in muslin and cotton cloth strainers, for surgical bandages, paper, lint, etc. Purified cotton is used in funnels for straining, in percolators for controlling the flow of the percolate, and for many other purposes.

GOSSYPIUM STYPTICUM. N. F. Styptic Cotton

[Gossyp. Stypt.]

	Metric	Old form	
Purified Cotton	**100 Gm.**	4 oz. av.	
Solution of Ferric Chloride	**80 mils**	3 fl. oz.	38 min.
Glycerin	**16 mils**		295 min.
Water	**225 mils**	10 fl. oz.	

Mix the solution of ferric chloride, glycerin and water, immerse the purified cotton in this solution, and allow it to remain one hour. Then remove it, press it until it has been brought to a weight of 300 Gm. [old form 12 oz. av.] and spread it out in thin layers, in a warm place protected from dust and light. When dry transfer it to well-closed glass containers.

Uses.—It is used as a hemostatic, being applied to wounds.

Products Resulting from the Decomposition of Cellulose

Under this head will be included—1. The preparations made by decomposing cellulose or lignin by the action of acids or alkalies. 2. Those made by destructive distillation.

Pyroxylin is placed in the first class, primarily because of its importance in pharmacy, medicine, and the arts.

PYROXYLINUM. U. S. Pyroxylin

[**Pyroxylin.**—SOLUBLE GUN COTTON]

A product obtained by the action of a mixture of nitric and sulphuric acids on cotton and consisting chiefly of cellulose tetranitrate [$C_{12}H_{16}(ONO_2)_4O_6+504.17$]. Preserve it in cartons, packed loosely, and protected from light and moisture.

Preparation.—The process official in the U. S. P. 1890 was as follows:

	Metric	Old form
Purifed Cotton	**100 Gm.**	**½ oz. av.**
Nitric Acid	**1400 mils**	**7 fl. oz.**
Sulphuric Acid	**2200 mils**	**11 fl. oz.**
Alcohol,		
Ether,		
Water, each, a sufficient quantity.		

Mix the acids gradually in a glass or porcelain vessel, and, when the temperature of the mixture has fallen to 32° C. (89.6°F.), add the purified cotton. By means of a glass rod imbue it thoroughly with the acids, and allow it to macerate, until a sample of it, taken out, thoroughly washed with a large quantity of water, and subsequently with alcohol, and pressed, is found to be soluble in a mixture of 1 volume of alcohol and 3 volumes of ether. Then remove the cotton from the acids, transfer it to a larger vessel, and wash it, first, with cold water, until the washings cease to have an acid taste, and then with boiling water, until they cease to redden blue litmus paper. Finally, drain the Pyroxylin on filter paper, and dry it in small, detached pellets, by means of a water bath or steam bath at a temperature not exceeding 60° C. (140° F.).

Shöbein first pointed out the fact that nitric acid acts on cotton and produces a soluble compound. It was subsequently proved that this substance, pyroxylin, or gun cotton, belongs to a series of closely related nitro-compounds in which the nitric acid radical replaces the hydroxyl of the cellulose formula. This is usually indicated as taking the double formula for cellulose $C_{12}H_{20}O_{10}$ with the displacement of the HO, thus:

$$\underset{\text{Nitric Acid}}{6HNO_3} + \underset{\text{Cellulose}}{C_{12}H_{20}O_{10}} = \underset{\text{Cellulose hexanitrate}}{C_{12}H_{14}O_4(NO_3)_6} + \underset{\text{Water}}{6H_2O}$$

$$\underset{\text{Nitric Acid}}{5HNO_3} + \underset{\text{Cellulose}}{C_{12}H_{20}O_{10}} = \underset{\text{Cellulose pentanitrate}}{C_{12}H_{15}O_5(NO_3)_5} + \underset{\text{Water}}{5H_2O}$$

$$\underset{\text{Nitric Acid}}{4HNO_3} + \underset{\text{Cellulose}}{C_{12}H_{20}O_{10}} = \underset{\text{Cellulose tetranitrate}}{C_{12}H_{16}O_6(NO_3)_4} + \underset{\text{Water}}{4H_2O}$$

$$\underset{\text{Nitric Acid}}{3HNO_3} + \underset{\text{Cellulose}}{C_{12}H_{20}O_{10}} = \underset{\text{Cellulose trinitrate}}{C_{12}H_{17}O_7(NO_3)_3} + \underset{\text{Water}}{3H_2O}$$

$$\underset{\text{Nitric Acid}}{2HNO_3} + \underset{\text{Cellulose}}{C_{12}H_{20}O_{10}} = \underset{\text{Cellulose dinitrate}}{C_{12}H_{18}O_8(NO_3)_2} + \underset{\text{Water}}{2H_2O}$$

Intermediate nitro-celluloses have also been prepared, Vieille having made at least eight different forms which suggested the possibility of double the cellulose formula shown above, but, today it is thought that these differences are due to mechanical mixtures of the various nitrocelluloses.

The soluble pyroxylin used in preparing collodion is a varying mixture of the di-, tri-, tetra-, and penta-nitrates, but mainly tetranitrate. The hexanitrate is the true explosive gun cotton, and is insoluble in ether, alcohol, acetone, or water.

Official Description.—A yellowish-white, matted mass of filaments, resembling raw cotton in appearance, harsh to the touch; exceedingly inflammable, burning, when unconfined, very rapidly and with a luminous flame; less explosive than cellulose hexanitrate.

When kept in well-closed bottles and exposed to the light, it is decomposed with the evolution of nitrous vapors, leaving a carbonaceous residue.

Solubility.—Slowly but completely soluble in 25 parts of a mixture of 3 volumes of ether and 1 volume of alcohol. Soluble in acetone and in glacial acetic acid and precipitated from these solutions on the addition of water.

Impurities and Tests for Impurities.—Saturate 0.5 Gm. of Pyroxylin with alcohol in a dish placed in cold water and then ignite the Pyroxylin at the top. When combustion is completed and the dish heated to redness, not more than 0.3 per cent. of ash remains.

Soluble Impurities.—Stir 1 Gm. of Pyroxylin with 20 mils of distilled water; the latter does not acquire an acid reaction, and on evaporating 10 mils of the filtered liquid to dryness on a water bath, not more than 0.0015 Gm. of residue remains.

U. S. P. Preparation.—Collodium, and, from Collodion, the several medicated Collodions are prepared (see pages 427–429).

Uses.—Pyroxylin has been used very largely by photographers for producing the basis of the sensitized film upon which impressions are made. It is now replaced to a great extent by gelatin. The composition known as *celluloid*, which is employed so largely for useful and ornamental articles, is made from pyroxylin, camphor, and coloring matter heated together and powerfuly pressed into appropriate moulds. Pharmaceutically, pyroxylin is used in collodions (see page 427).

ACIDUM OXALICUM. Oxalic Acid

$H_2C_2O_4+2H_2O=126.05$

This acid was omitted from the alphabetical list of chemical substances in the U. S. Pharmacopœia; it is found, however, among the official reagents (see Chapter LXII).

Preparation.—Oxalic acid is frequently found in plants in the form of the oxalates of potassium and calcium. It may be made by acting on cellulose, sugar, or starch with nitric acid, with the aid of heat, and is prepared on a commercial scale by heating dried sawdust with a mixture of two molecules of caustic soda and one molecule of caustic potash. The mixture of caustic alkalies and sawdust is made in a thick paste, and then heated for several hours *in vacuo* to a temperature of 180° C. (356° F.). The gray mass is then washed with sodium carbonate, whereby the potash is removed as carbonate, the less soluble sodium oxalate remaining. This is converted into calcium oxalate by milk of lime, and the calcium salt is then decomposed with sulphuric acid. The impure oxalic acid is then purified by recrystallization.

It is also prepared on a large scale by heating a mixture of potassium formate with a little potassium oxalate and a slight excess of alkali. The oxalate so obtained is liberated by the addition of sulphuric acid.

It occurs in small, colorless clino-rhombic crystals, which are odorless and have a very sour taste; it is slightly efflorescent in dry air, fusible at 98° C. (208.4° F.), and entirely volatile at a red heat.

The crystals should dissolve in ten parts of distilled water at 25° C. (77° F.). It is soluble in 4.5 parts of absolute alcohol, and in 2.5 parts of alcohol, and is almost insoluble in ether, chloroform, benzene, and petroleum benzin. It fuses in its water of hydration at 98° C. (208.4° F.), although continued exposure to a heat of 60° to 70° C. (140° to 158° F.) will render it perfectly anhydrous. Solutions of oxalic acid at 100° C. (212° F.) lose acid by sublimation, and at 157° C. (314.6° F.) it sublimes rapidly. If the heat rises to 160° C. (320° F.), much loss of acid occurs. (See Reagents, Chapter LXII.)

It combines with salifiable bases, and forms salts called oxalates. The most important of these are the three *potassium salts—oxalate, binoxalate*, and *quadroxalate* (acid potassium oxalate plus free oxalic acid), *ammonium oxalate* (used as a test), and *calcium oxalate*. The binoxalate and quadroxalate, both popularly called *salt of sorrel* or *essential salt of lemons*, are employed for removing iron stains from linen, and act by their excess of acid, which forms a soluble salt with the ferric oxide constituting the stain.

This acid in solution combines readily with lime, and forms with it an insoluble white precipitate consisting of calcium oxalate, which is insoluble in an excess of oxalic or acetic acid, but is dissolved by dilute hydrochloric acid.

Uses.—This acid was used in the U. S. P. VIII in volumetric estimation for establishing a standard for volumetric solutions, since a pure acid may be easily obtained and a definite quantity weighed. It is among the test solutions and volumetric solutions of the U. S. Pharmacopœia IX. It is not, however, as largely used as in former Pharmacopœias, due to the tendency of the solution to crystallize at the delivery point of the burette and cause errors through the crystals falling into the solution which is being tested.

The best antidote to poisoning by oxalic acid is a paste made by mixing prepared chalk or powdered chalk with water or lime water; it must be administered promptly and freely.

Products Resulting from the Destructive Distillation of Cellulose and Lignin

When wood is distilled in close vessels many products are obtained. These vary with the kind of wood used, the care used in the distillation, and the temperature at which the distillation is effected. When dry hard woods (oak, walnut, or beech) are distilled, about 25 per cent. of charcoal is obtained; the liquid portion amounts to about 53 per cent., while the remainder, 22 per cent., is represented by waste products, principally uncondensible gases, carbon dioxide, carbon monoxide, etc. The principal solid, liquid, and gaseous products are shown by the following list:

Solids.—Charcoal, inorganic salts, etc. **Liquids.**—1. Aqueous liquid, containing *acetic, formic, butyric, crotonic, capronic, propionic acids, acetone, methyl alcohol, furfurol, methylamine, pyrocatechin,* and some small quantities of empyreumatic oils and resins. 2. Tarry liquid, containing *toluol, xylol, cumol, methol, mesitylene, pseudocumol, phenol, cresol, guaiacol, creosol, phlorol, and methylcreosol, naphthalene, paraffin, pyrene, chrysene, retene, mesit.* **Gases.**—*Carbon dioxide, carbon monoxide, marsh-gas, acetylene, ethylene, propene,* and others. The most important products are charcoal, tar, acetic acid, acetone, methyl alcohol, and creosote. Of these, charcoal has been considered on page 703.

ACIDUM ACETICUM. U. S. Acetic Acid
[Acid. Acet.]

An aqueous solution containing not less than 36 per cent. nor more than 37 per cent. of $C_2H_4O_2$ or $CH_3.COOH$ (60.03).

Preparation.—The best acetic acid for pharmaceutical and medical uses is now made by subjecting oak wood, cut into small billets, to a carefully regulated heat, the temperature being much less than that necessary to produce charcoal. The distilled aqueous liquid (*pyroligneous acid*) is treated with soda ash and the resulting sodium acetate decomposed by sulphuric acid and the acetic acid recovered by distillation. The advantages are that the production of the empyreumatic substances, which constitute the most objectionable impurities in the commercial acid, is largely curtailed, the process being at the same time more economical, as the residue of slightly darkened wood is more valuable than the completely charred carbon left by the ordinary process (see U. S. Dispensatory).

Acetic acid is also made by distilling *vinegar*, a liquid made by the oxidation of dilute alcoholic liquids, such as cider, wine, etc. In Germany acetic acid is made by mixing alcohol with water in the proportion of eight parts of the former to ninety-two parts of the latter, and then pouring it upon beech wood shavings, so that as it trickles through it is oxidized by the action of the air. Aldehyde is an intermediate product. This " quick vinegar " process is now extensively used in the United States.

$$\underset{\text{Alcohol}}{C_2H_6O} + \underset{\text{Oxygen}}{O} = \underset{\text{Aldehyde}}{C_2H_4O} + \underset{\text{Water}}{H_2O}$$

$$\underset{\text{Aldehyde}}{C_2H_4O} + \underset{\text{Oxygen}}{O} = \underset{\text{Acetic Acid}}{C_2H_4O_2}$$

or

$$\underset{\text{Alcohol}}{C_2H_6O} + \underset{\text{Oxygen}}{O_2} = \underset{\text{Acetic Acid}}{C_2H_4O_2} + \underset{\text{Water}}{H_2O}$$

Various strengths of acetic acid are found in commerce—the official acid (36 to 37 per cent.), which has the sp. gr. 1.045 at 25° C. (77° F.), stronger acids of 60 or 80 per cent. strengths, which may be used economically for making the weaker acid, and also the *No. 8 acid*, as it is called (30 per cent.), which is still used; the latter has the sp. gr. 1.038 at 25° C. (77° F.), and is weaker than the official acid. It is termed "No. 8" because it was formerly used in the proportion of one part in eight to make the ordinary diluted acetic acid, or distilled vinegar. The salts of acetic acid are termed acetates; they are all soluble in water, and may be recognized by heating with sulphuric acid, when the odor of acetic acid will be developed; a neutral solution of an acetate is colored deep red by a solution of ferric chloride, and, if the mixture is boiled, a brownish-red oxyacetate is precipitated.

Official Description.—A clear, colorless liquid.

Odor, Taste, and Reaction.—A strong, characteristic, vinegar-like odor, a sharply acid taste, and a strongly acid reaction.

Miscibility.—Acetic Acid is miscible with water or alcohol.

Specific Gravity.—About 1.045 at 25° C. (77° F.).

Tests for Identity.—Add sufficient ammonia water to Acetic Acid to neutralize it or to leave the Acid in slight excess, and then add ferric chloride T.S.; a blood-red color develops which is discharged by strongly acidulating the liquid with sulphuric acid.

Impurities and Tests for Impurities.—Evaporate 20 mils of Acetic Acid to dryness on a water bath; not more than 0.002 Gm. of residue remains.

Heavy Metals.—Acetic Acid diluted with 20 volumes of distilled water does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Sulphuric Acid.—Separate portions of 1 mil of each Acetic Acid, diluted with 10 volumes of distilled water, show no turbidity on the addition of a few drops of barium chloride T.S.

Hydrochloric Acid.—Nor any opalescence with a few drops of silver nitrate T.S.

Formic or Sulphurous Acid.—Supersaturate 5 mils of the Acid with 10 mils of ammonia water, add 5 mils of tenth-normal silver nitrate V.S. and boil the solution for one or two minutes; no dark deposit is produced.

Empyreumatic Substances.—Dilute 4 mils of the Acid, in a glass-stoppered bottle with 20 mils of distilled water and add 0.5 mil of tenth-normal potassium permanganate V.S. The pink tint is not changed to brown at once, and does not become entirely brown or free from pinkish-brown in less than half a minute.

Assay.—Pour about 6 mils of Acetic Acid into a tared flask, stopper and weigh accurately, dilute with 50 mils of distilled water, and titrate with normal potassium hydroxide V.S., using phenolphthalein T.S. as indicator. It shows not less than 36 per cent. nor more than 37 per cent. of $C_2H_4O_2$. Each mil of normal potassium hydroxide V.S. used corresponds to 0.06003 Gm. of $C_2H_4O_2$. Each gramme of Acetic Acid corresponds to not less than 6.00 mils nor more than 6.16 mils of normal potassium hydroxide V.S.

U. S. P. Preparations.—Acidum Aceticum Dilutum; Syrupus Ipecacuanhæ.

N. F. Preparations.—Acetum Aromaticum; Linimentum Terebinthinæ Aceticum; Liquor Alumini Subacetatis; Syrupus Sanguinariæ.

Uses.—Acetic acid is used in pharmacy as a solvent and menstruum, and for making the diluted acetic acid.

ACIDUM ACETICUM DILUTUM. U. S. Diluted Acetic Acid
[Acid. Acet. Dil.]

An aqueous solution containing not less than 5.7 nor more than 6.3 per cent. of $C_2H_4O_2$ or $CH_3.COOH$ (60.03).

	Metric	Old form
***Acetic Acid**	**120 Gm.**	5 fl. oz. 35 min.
Distilled Water	**610 Gm.**	26 fl. oz. 445 min.
To make	**730 Gm.**	2 pints

Mix them.

Miscibility.—It is miscible with water or alcohol.

Specific Gravity.—About 1.008 at 25° C. (77° F.)

Tests for Identity and Impurities.—Diluted Acetic Acid responds to the tests for identity and purity under *Acidum Aceticum*, allowance being made for the difference in strength.

Assay.—Pour about 25 mils of Diluted Acetic Acid into a tared flask, weigh accurately, and titrate with normal potassium hydroxide V.S., using phenolphthalein T.S. as indicator. It shows not less than 5.8 nor more than 6.3 per cent. of $C_2H_4O_2$. Each mil of normal potassium hydroxide V.S. used corresponds to 0.06003 Gm. of $C_2H_4O_2$. Each gramme of Diluted Acetic Acid corresponds to not less than 0.95 mil nor more than 1.05 mils of normal potassium hydroxide V.S.

U. S. P. Preparations.—Acetum Scillæ; Liquor Ammonii Acetatis; Liquor Ferri et Ammonii Acetatis.

N. F. Preparations.—Acetum Opii; Liquor Strychninæ Acetatis; Mistura Adstringens; Syrupus Allii.

Uses.—Diluted acetic acid is superior to vinegar as a menstruum, and is used officially because of its greater purity, more uniform strength, and freedom from color. The dose is thirty minims (2 mils).

ACIDUM ACETICUM GLACIALE. U. S. Glacial Acetic Acid
[Acid. Acet. Glac.]

A liquid containing not less than 99 per cent. of $C_2H_4O_2$ or $CH_3.COOH$ (60.03). Preserve it in glass-stoppered bottles.

Preparation.—This acid (which is termed "glacial" because of its glassy appearance at low temperatures) is made by fusing carefully fifty-four parts of pure crystallized sodium acetate; the residue is coarsely powdered, placed in a retort, mixed with forty parts of pure concentrated sulphuric acid, and distilled; the distillate is glacial acetic acid.

$$\underset{\text{Sodium Acetate}}{NaC_2H_3O_2} + \underset{\text{Sulphuric Acid}}{H_2SO_4} = \underset{\text{Glacial Acetic Acid}}{HC_2H_3O_2} + \underset{\text{Acid Sodium Sulphate}}{NaHSO_4}$$

It is also prepared by distilling calcium acetate with sodium polysulphate, $Na_2H_3(SO_4)_2$, which acts like sulphuric acid without giving undesirable secondary products.

The specific gravity of glacial acetic acid (100 per cent.) is 1.0471 at 25° C. (77° F.), and the specific gravity of 39 per cent. acetic acid is nearly the same, 1.0474, while 79, 80, 77, and 76 per cent. acids have exactly the same density. It will thus be seen that specific gravity cannot be relied upon as a criterion for strength. The glacial acid may, however, be distinguished from the 39 per cent. acid by adding 10 per cent. of water, when, if the density increases, the specimen is the stronger acid. (See Acetic Acid table, U. S. P. IX.)

Official Description.—A clear, colorless liquid.

Odor and Taste.—It has a strong, vinegar-like odor, and a very pungent, acid taste.

Miscibility.—It is miscible with water or alcohol.

Specific Gravity.—From 1.047 to 1.050 at 25° C. (77° F.).

Tests for Identity.—It boils between 117° and 118° C. (242.6° and 244.4° F.).

Congealing point: not below 14.5° C. (58° F.).

Tests for Impurities.—Glacial Acetic Acid responds to the tests for identity and purity under *Acidum Aceticum* when diluted to that strength, but the tint produced by the addition of 0.1 mil of tenth-normal potassium permanganate V.S. to 2 mils of Glacial Acetic Acid, diluted with 10 mils of distilled water and contained in a glass-stoppered bottle, is not changed to brown within two hours.

Assay.—Pour about 2.5 mils of Glacial Acetic Acid into a tared flask containing 10 mils of distilled water, stopper and weigh accurately, dilute with 40 mils of distilled water, and titrate this solution with normal potassium hydroxide V.S., using phenolphthalein T.S. as indicator. It shows not less than 99 per cent. of $C_2H_4O_2$. Each mil of normal potassium hydroxide V.S. used corresponds to 0.06003 Gm. of $C_2H_4O_2$. Each gramme of Glacial Acetic Acid corresponds to not less than 16.5 mils of normal potassium hydroxide V.S.

U. S. P. Preparations.—Ceratum Cantharidis; Collodium Cantharidatum.

N. F. Preparations.—Liquor Alumini Acetico-Tartratis; Liquor Ferri Acetatis.

Uses.—Glacial acetic acid is a solvent for oil of lemon and other oils; and, medicinally, it is a caustic and vesicant when applied externally. It is often sold under various disguises as a corn solvent.

ACIDUM TRICHLORACETICUM. U. S. Trichloracetic Acid [Acid. Trichloracet.]

A monobasic organic acid. It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99 per cent. of of $C_2HO_2Cl_3$ or $CCl_3.COOH$ (163.39). Preserve it in well-stoppered bottles, in a cool place, protected from light.

Preparation.—This acid, discovered by Dumas in 1838, may be made by oxidizing 165.5 Gm. of hydrated chloral, previously fused at 58° C. (136.4° F.), with 63 Gm. of fuming nitric acid, and placing the mixture aside for an hour or until the red fumes have disappeared; the liquid is then distilled, and the portion coming over above 190° C. (374° F.) is trichloracetic acid, which is then crystallized.

Official Description.—It occurs in colorless, deliquescent, rhombohedral crystals,.

Odor and Reaction.—It has a slight, characteristic odor. An aqueous solution of Trichloracetic Acid (1 in 20) is acid to litmus.

Solubility.—One Gm. of Trichloracetic Acid dissolves in about 0.1 mil of water at 25° C. (77° F.); it is very soluble in alcohol and ether at 25° C. (77° F.).

Tests for Identity.—When the Acid is heated with potassium hydroxide T.S., it is decomposed with the formation of chloroform and potassium carbonate.

Impurities and Tests for Impurities.—Incinerate about 2 Gm. of Trichloracetic Acid not more than 0.05 per cent. of ash remains.

Chlorides.—Ten mils of a freshly made, aqueous solution of the Acid (1 in 20) does not immediately become more than slightly opalescent upon the addition of a few drops of silver nitrate T.S.

Nitric Acid.—Dissolve a small crystal of ferrous sulphate in 5 mils of an aqueous solution of Trichloracetic Acid (1 in 20), and pour this solution upon 5 mils of sulphuric acid (free from nitrogen compounds) so as to form a layer above; no brownish-red color is produced at the zone of contact of the two liquids.

Assay.—Dissolve about 4 Gm. of Trichloracetic Acid, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed in a tared and stoppered flask, in 50 mils of distilled water, add a few drops of phenolphthalein T.S. and titrate this solution with normal potassium hydroxide V.S. It shows, in the dried acid, not less than 99 per cent. of $C_2HO_2Cl_3$. Each mil of normal potassium hydroxide V.S. corresponds to 0.16339 Gm. of $C_2HO_2Cl_3$. Each gramme of Trichloracetic Acid, previously dried, corresponds to not less than 6.06 mils nor more than 6.12 mils of normal potassium hydroxide V.S.

Uses.—This acid was first introduced into the U. S. P. VIII; it is used as a caustic in solution or in crystals.

ACETONUM. U. S. Acetone

[**Aceton.**—Dimethyl-ketone]

A liquid containing not less than 99 per cent. by weight of C_3H_6O or $CH_3.CO.CH_3$ (58.05). Preserve it in well-closed containers, in a cool place, remote from fire.

Preparation.—This liquid may be made by the distillation of dry calcium acetate at 290° C. (554° F.); it is also found in crude wood spirit in varying proportions; it is separated from methyl alcohol, which constitutes the principal bulk in the wood spirit, with difficulty, because methyl alcohol boils at 55° C. (131° F.) and acetone at about 56.5° C. (133.7° F.), the difference being too slight to use fractional distillation with success.

Official Description.—A transparent, colorless, mobile and volatile liquid.

Odor, Taste, and Reaction.—It has a characteristic ethereal odor and a pungent, sweetish taste. Acetone does not affect the color of blue or red litmus paper previously moistened with water.

Specific Gravity.—About 0.790 at 25° C. (77° F.).

Miscibility.—Miscible without cloudiness with water, alcohol, ether, chloroform, and with most volatile oils.

Tests for Identity.—It volatilizes even at low temperatures and boils between 56° and 58° C. (132.8° and 136.4° F.). It is inflammable and burns with a luminous, non-sooty flame.

Impurities and Tests for Impurities.—Evaporate 25 mils of Acetone in a platinum or porcelain dish on a water bath; not more than 0.002 Gm. of residue remains.

Empyreumatic Substances.—Mix 20 mils of Acetone in a clean, glass-stoppered bottle, with 0.1 mil of tenth-normal potassium permanganate V.S.; the pink tint so produced does not wholly disappear in less than fifteen minutes.

Assay.—Pour about 1 mil of Acetone into a tared weighing-bottle having a stopper, determine the weight of the acetone added, partly fill the bottle with distilled water, and again weigh accurately. Transfer the contents of the bottle, washing the bottle well with distilled water, to a 1000 mil graduated flask, fill to the mark with distilled water, and mix the contents thoroughly. Place 25 mils of normal potassium hydroxide V.S. in a 250 mil glass-stoppered flask, add exactly 25 mils of the Acetone solution (representing one-fortieth of the weight of Acetone taken), then, with constant agitation of the flask, add 35 mils of tenth-normal iodine V.S., and allow the mixture to stand for fifteen minutes. Now add 26 mils of normal hydrochloric acid V.S. and at once titrate the residual iodine with tenth-normal sodium thiosulphate V.S., with the addition of starch T.S. as indicator when the liquid is nearly decolorized. Conduct a blank test with the same quantities of the reagents and subtract the quantity of tenth-normal iodine V.S. consumed in this blank test from that consumed in the assay. Each mil of this difference, which represents the iodine consumed by the reaction with the Acetone, corresponds to 0.0009675 Gm. of C_3H_6O. Each gramme of Acetone corresponds to not less than 1023 mils of tenth-normal iodine V.S.

U. S. P. Preparation.—Collodium Cantharidatum.
N. F. Preparation.—Petroxolinum Iodoformi.

Uses.—Acetone was used in the U. S. P. VIII as the menstruum in the preparation of oleoresins but is now replaced by ether. It is used as a solvent for dissolving fatty bodies, resins, pyroxylin, etc. It is at present largely used in the manufacture of chloroform.

PIX LIQUIDA. U. S. Tar

[**Pix Liq.**—Pine Tar]

A product obtained by the destructive distillation of the wood of *Pinus palustris* Miller, or of other species of *Pinus* (Fam. *Pinaceæ*).

Preparation.—Tar is usually obtained as a by-product in the manufacture of charcoal or acetic acid (see page 985).

Official Description.—A semi-liquid, viscid, blackish-brown, non-crystalline, translucent in thin layers, becoming granular and opaque with age.

Odor, Taste, and Reaction.—Odor empyreumatic, terebinthinate, taste sharp and empyreumatic, the aqueous solution being of a pale yellowish to yellowish-brown color and acid to litmus.

Miscibility.—Tar is miscible with alcohol, ether, chloroform, glacial acetic acid, or fixed or volatile oils; it is heavier than water and is slightly soluble in it.

Tests for Identity.—The addition of a drop of ferric chloride T.S. to 10 mils of an aqueous solution of tar produces a greenish-brown color.

U. S. P. Preparations.—Syrupus Picis Liquidæ; Unguentum Picis Liquidæ.

N. F. Preparations.—Glyceritum Picis Liquidæ; Liquor Picis Alkalinus; Vinum Picis.

Uses.—The volatile products of tar are expectorant, and tar inhalations are often used. The dose of the oil is 8 grains [0.5 Gm.]. Externally, tar is stimulating, and is used in skin diseases.

LIQUOR PICIS ALKALINUS. N. F. Alkaline Solution of Tar

[Liq. Pic. Alk.]

	Metric	Old form
Tar	**250 Gm.**	8 oz. av. 151 gr.
Potassium Hydroxide	**125 Gm.**	4 oz. av. 76 gr.
Water, a sufficient quantity,		
To make	**1000 mils**	2 pints

Dissolve the potassium hydroxide in 625 mils [old form 20 fl. oz.] of water, add the tar and agitate until solution is effected. Allow it to stand twenty-four hours, then strain the solution through purified cotton and pass sufficient water through the strainer to make the product measure 1000 mils [old form 2 pints].

Uses.—Used externally as an antiseptic in dermatologic practice.

OLEUM PICIS LIQUIDÆ RECTIFICATUM. U. S. Rectified Oil of Tar

[**Ol. Pic. Liq. Rect.**—OLEUM PICIS LIQUIDÆ, U. S. P. VIII RECTIFIED TAR OIL]

A rectified volatile oil distilled from tar.

Official Description.—A thick liquid having a dark reddish-brown color.

Odor, Taste, and Reaction.—It has a strong, empyreumatic odor and taste. The aqueous solution is acid to litmus.

Solubility.—It is soluble in alcohol.

Specific Gravity.—0.960 to 0.990 at 25° C. (77° F.).

N. F. Preparations.—Mistura Olei Picis; Petroxolinum Picis; Unguentum Picis Compositum.

Uses.—The constituents of oil of tar are complex and numerous; the residue left after the distillation of tar is *black pitch*. The oil is preferred to tar for most medicinal uses, because the insoluble and inert substances have been separated. The dose is 3 minims (0.2 mil).

OLEUM CADINUM. U. S. Oil of Cade

[**Ol. Cadin.**—CADE OIL OIL OF JUNIPER TAR OLEUM JUNIPERI EMPYREUMATICUM]

An empyreumatic oil obtained by the dry distillation of the wood of *Juniperus Oxycedrus* Linné (Fam. *Pinaceæ*).

Official Description.—A dark brown, clear, thick liquid.

Odor, Taste, and Reaction.—It has a tarry, empyreumatic odor and a warm, faintly aromatic and bitter taste. It imparts an acid reaction to water.

Solubility.—It is almost insoluble in water. It is only partially soluble in acohol or petroleum benzin, completely soluble in 3 volumes of ether, soluble in amyl alcohol, chloroform, glacial acetic acid, or oil of turpentine.

Specific Gravity.—0.980 to 1.055 at 25° C. (77° F.).

Tests for Identity.—Shake 1 part of Oil of Cade with 20 parts of warm distilled water and filter; separate portions of this filtrate give a red coloration with a few drops of ferric chloride solution (1 in 1000) and reduce silver ammonium nitrate T.S. in the cold and alkaline cupric tartrate T.S. on heating.

Impurities and Tests for Impurities.—*Rosin and Rosin Oil.*—Agitate 1 mil of Oil of Cade with 15 mils of purified petroleum benzin, filter the benzin solution, add an equal volume of copper acetate solution (1 in 100), shake the mixture and then allow it to separate. On adding an equal volume of ether to the separated benzin solution, it produces no intensely green coloration and does not become colored more than light yellow to brown.

N. F. Preparations.—Linimentum Saponis Mollis Compositum; Petroxolinum Cadini; Petroxolinum Sulphuratum Compositum; Unguentum Sulphuris Compositum.

Uses.—Its uses in medicine are the same as those of tar and oil of tar (see page 989).

CREOSOTUM. U. S. Creosote

[**Creosot.**—CREASOTE]

A mixture of phenols and phenol derivatives, chiefly guaiacol and creosol, obtained during the distillation of wood-tar. Preserve it in tightly stoppered, dark amber-colored bottles.

Preparation.—This is a product of the distillation of wood tar, consisting mainly of the following phenols: *guaiacol*, or *oxycresol*, $C_7H_8O_2$, boiling at 200° C. (392° F.); *creosol*, $C_8H_{10}O_2$, boiling at 217° C. (422.6° F.); *methyl-creosol*, $C_9H_{12}O_2$, boiling at 214° C. (417.2° F.) to 218° C. (424.4° F.); and *phlorol*, $C_8H_{10}O$, boiling at 219° C. (426.2° F.).

Wood-tar, preferably that from beechwood, is distilled until about one-half passes over and the dense vapors of paraffin appear. The distillate separates into three strata, the lower of heavy, the upper of lighter oily liquid, with an aqueous acid layer between. The oil contains *eupion*, which is a liquid consisting chiefly of pentane. The heavy oil is then shaken with a concentrated solution of sodium carbonate, to neutralize the acetic acid, the separated oily liquid is again distilled and only the portion heavier than water collected. The distillate is now treated with potassium hydroxide, in which the creosote dissolves, the eupion separating. Sulphuric acid is now added to neutralize the potassium hydroxide and the separated creosote is well washed with water and redistilled, the portion coming over between 200° and 220° C. (392° and 428° F.) being collected. Formerly much of the liquid sold for and labeled " creosote " in the market was impure phenol (carbolic acid), or coal-tar creosote. In view of the extensive use of wood creosote in large doses internally in phthisis, the liability of administering a large dose of phenol and causing death through this substitution is very great. Phenol may be distinguished from true wood creosote by the tests given below. The odor of each is distinctive and characteristic.

Official Description.—An almost colorless or yellowish, highly refractive, oily liquid; it does not readily become brown on exposure to light.

Odor, Taste, and Reaction.—It has a penetrating, smoky odor, and a burning, caustic taste. It is neutral or faintly acid to litmus.

Solubility.—Creosote is slightly soluble in water; it is miscible with alcohol, ether, or fixed or volatile oils.

Specific Gravity.—Not below 1.073 at 25° C. (77° F.).

Tests for Identity.—It begins to distil between 195° and 200° C. (383° and 392° F.) and not less than 80 per cent. by volume distils between 200° and 220° C. (392° and 428° F.).

Creosote is inflammable, burning with a luminous, smoky flame.

Add 1 drop of ferric chloride T.S. to 10 mils of a saturated aqueous solution of Creosote; the liquid develops a violet-blue color, which is very transient; it then clouds almost instantly, the color passing rapidly from a grayish-green to a muddy brown, with finally the formation of a brown precipitate.

Impurities and Tests for Impurities.—*Phenol and so-called "Coal-tar Creosote".*—Mix equal volumes of Creosote and collodion in a dry test tube; no permanent coagulum is produced.

"Coal-tar Creosote".—Mix 4 mils of Creosote with 4 mils of glycerin; a clear mixture results, from which a creosotic layer, equal to or greater in volume than the Creosote taken, separates on the addition of 1 mil of water.

Hydrocarbons and Bases.—Two mils of Creosote requires not less than 10 mils nor more than 18 mils of normal sodium hydroxide V.S. to produce a clear liquid. This liquid remains unclouded on diluting with 50 mils of distilled water.

Cœrulignol and some other High-boiling Constituents of Wood-tar.—Shake gently 1 mil of Creosote with 2 mils of petroleum benzin and 2 mils of freshly prepared barium hydroxide T.S., until a uniform mixture is produced. Upon complete separation three distinct layers are visible; a middle layer containing the Creosote, a benzin layer which is neither blue nor muddy, and an aqueous layer which does not acquire a red tint.

U. S. P. Preparation.—Aqua Creosoti.

N. F. Preparations.—Mulla Creosoti Salicylata; Petroxolinum Chloroformi Camphoratum.

Uses.—Creosote is a powerful antiseptic. It is used as a caustic application, and is frequently applied upon cotton to exposed nerves in teeth, when it acts as a local anæsthetic. It is also hemostatic when applied to bleeding surfaces. In the form of creosote water it is used internally to check nausea. When taken internally, undiluted, and in large doses, it is a powerful poison. The administration of mucilaginous drinks, and the prompt evacuation of the stomach by the stomach pump, would be the best treatment, no antidote to poisoning by creosote being known. In phthisis it is given internally in doses of four to fifteen minims (0.25-1 mil) per day.

CREOSOTI CARBONAS. U. S. Creosote Carbonate
[Creosot. Carb.]

A mixture of the carbonates of various constituents of creosote, chiefly guaiacol and creosol.

Preparation.—It is prepared by passing a current of carboxyl chloride or phosgene into a solution of creosote in sodium hydroxide and washing the product with weak soda solution and water.

Official Description.—A clear, colorless or yellowish, viscid liquid. On prolonged exposure to a low temperature, crystals of guaiacol carbonate separate, which redissolve on warming.

Odor, Taste, and Reaction.—Odorless, and tasteless, or having a slight odor and taste of creosote.

Solubility.—It is insoluble in water and freely soluble in alcohol, soluble in petroleum benzin or fixed oils; it is miscible with chloroform or benzene.

Specific Gravity.—1.145 to 1.170 at 25° C. (77° F.).

Tests for Identity.—Heat about 0.5 mil of Creosote Carbonate for a few minutes with 10 mils of alcoholic potassium hydroxide T.S., and cool the mixture; a crystalline precipitate forms, which effervesces with acids.

Incinerate about 1 Gm. of Creosote Carbonate; not more than 0.1 per cent. of ash remains.

Impurities and Tests for Impurities.—*Creosote.*—A saturated alcoholic solution of Creosote Carbonate is neutral to moistened litmus paper, and requires only a yellow color on the addition of ferric chloride T.S.

Heat 25 mils of Creosote Carbonate on a water bath for half an hour with a solution of 15 Gm. of potassium hydroxide in 100 mils of alcohol, then evaporate the alcohol and mix the residue with an excess of hydrochloric acid; a liquid composed of two layers is obtained. On now separating the dark layer of creosote and shaking it with successive portions of 10 mils each of distilled water until the washings are only slightly acid to litmus, it has the boiling point given under *Creosotum;* the distillate, after separation of adhering water, responds to the remaining tests of identity and purity under *Creosotum.*

Uses.—This preparation, also sold in the trade under the name *creosotal,* possesses the same medicinal properties as creosote but is claimed to be non-toxic and devoid of irritating properties. Used in tuberculosis, pneumonia, and as an intestinal antiseptic in doses of five to fifteen grains (0.3-1 Gm.).

GUAIACOL. U. S. Guaiacol

The monomethyl ether [$C_7H_8O_2$ or $C_6H_4(OH)(OCH_3)$ 1:2 = 124.06] of ortho-dihydroxybenzene, obtained from wood-tar creosote or prepared synthetically. Preserve it in well-closed containers, protected from light.

Preparation.—It may be obtained from wood creosote by fractional distillation and purification or produced synthetically by heating a mixture of equal molecules of pyrocatechin, potassium hydroxide and potassium methylsulphate, in a closed vessel at a temperature of 170° to 180°C. (338° to 356°F.), resulting in the following reaction:

$$\underset{\text{Pyrocatechin}}{C_6H_4(OH)_2} + \underset{\text{Potassium Hydroxide}}{KOH} + \underset{\text{Potassium Methylsulphate}}{KCH_3SO_4} = \underset{\text{Guaiacol}}{C_6H_4.OH.OCH_3} + \underset{\text{Potassium Sulphate}}{K_2SO_4} + \underset{\text{Water}}{H_2O}$$

The resulting guaiacol is removed by solution in alcohol or benzin and purified by recrystallizing.

Official Description.—A colorless or yellowish, strongly refractive liquid, or a colorless or yellowish, crystalline solid.

Odor, Taste, and Reaction.—It has an agreeable, aromatic odor. It becomes darker on exposure to light and air. The solid form when liquefied may remain so for some time even at a low temperature.

Solubility.—One Gm. of Guaiacol dissolves in 53 mils of water and in 0.8 mil of glycerin at 25° C. (77° F.), but separates from the glycerin on the addition of water; miscible with alcohol, chloroform, ether or acetic acid.

Specific Gravity.—Liquid Guaiacol, between 1.110 and 1.114 at 25° C. (77° F.).

Tests for Identity.—Solid Guaiacol melts at about 28° C. (82.4° F.).

Not less than 85 per cent. of Guaiacol distils between 200° and 210° C. (392° and 410° F.).

The addition of a drop of ferric chloride T.S. to 10 mils of an alcoholic solution of Guaiacol (1 in 100) produces an immediate blue color, changing to emerald-green, and finally becoming yellowish.

Impurities and Tests for Impurities.—Incinerate about 1 Gm. of Guaiacol; not more than 0.1 per cent. of ash remains.

Shake 2 mils of liquefied Guaiacol with 4 mils of purified petroleum benzin; the mixture separates on standing into two distinct, clear layers. Permanent turbidity or failure to separate into layers indicates the presence of impurities.

Oily Hydrocarbons.—One mil of liquefied Guaiacol dissolves in 2 mils of potassium hydroxide solution (15 per cent.), when heated for one minute in boiling water; on cooling, it congeals to a nearly white mass. Much coloration or failure to congeal indicates the presence of impurities. The mass thus obtained forms a clear solution with 20 volumes of distilled water (turbidity indicates *oily hydrocarbons*).

N. F. Preparation.—Petroxolinum Guaiacolis.

Uses.—Guaicol is used internally as a remedy in tuberculosis in doses of five to ten minims (0.3 to 0.6 mil) and by inhalation.

GUAIACOLIS CARBONAS. U. S. Guaiacol Carbonate [Guaiacol. Carb.]

A guaiacol derivative [$(C_7H_7O)_2CO_3$ or $(C_6H_4(OCH_3)O)_2.CO = 274.11$].

Preparation.—It may be prepared by slowly passing carbonyl chloride into guaiacol, in sodium hydroxide solution, washing the resulting precipitate and crystallizing it from alcohol.

Official Description.—A crystalline powder.

Odor, Taste, and Reaction.—Odorless and tasteless or having a slight, aromatic odor and taste. It is not acid to litmus paper which has been previously moistened with distilled water.

Solubility.—Guaiacol Carbonate is insoluble in water; 1 Gm. dissolves in 60 mils of alcohol, 1 mil of chloroform, and in 18 mils of ether at 25° C. (77° F.), freely soluble in benzene and slightly soluble in glycerin or fixed oils; freely soluble in boiling alcohol.

Tests for Identity.—It melts between 83° and 87° C. (181.4° and 188.6° F.).

Impurities and Tests for Impurities.—Incinerate 1 Gm. of Guaiacol Carbonate; not more than 0.1 per cent. of ash remains.

Free Guaiacol.—A saturated alcoholic solution of Guaiacol Carbonate yields no bluish-green color on the addition of ferric chloride T.S.

Readily Carbonizable Impurities.—One-tenth Gm. of Guaiacol Carbonate dissolves in 2 mils of sulphuric acid without producing more than a faint yellow color.

Heat about 0.5 Gm. of Guaiacol Carbonate for a few minutes with 10 mils of alcoholic potassium hydroxide T.S. and cool the mixture; a crystalline precipitate is formed, which effervesces with acids. If the alcohol is evaporated from the filtered liquid, the residue supersaturated with diluted sulphuric acid and shaken out with ether, the separated ether layer, upon spontaneous evaporation of the ether, leaves a residue which responds to the tests for identity under *Guaiacol.*

Uses.—Guaiacol Carbonate, known also as *duotal,* is given as a remedy in tuberculosis in doses of eight to fifteen grains (0.5 to 1 Gm.).

Unofficial Product of the Destructive Distillation of Cellulose

Methyl Alcohol, CH_3OH Methylic Alcohol Wood Naphtha Wood Alcohol Pyroxylic Spirit Columbian Spirit	It occurs among the products of the dry distillation of wood. The watery liquid is separated from the tar and distilled; then the first portion of the distillate is rectified over slaked lime, so as to remove acid, etc., and the product treated with sulphuric acid to remove tar and neutralize ammonia and methylamine, and, lastly, redistilled. It is a colorless, limpid liquid, of a peculiar odor, resembling alcohol and acetic ether, and of a warm taste. Its specific gravity is about 0.7984 at 15° C. (59° F.), and boiling point about 66° C. (150.8° F.). It is a good solvent for volatile oils, fats, and many resins. When purified it is designated as Columbian Spirit, and although this is rectified it should never be used internally; death and permanent blindness have been produced through the administration of methyl alcohol. The practice of substituting any form of this liquid for ethyl alcohol in pharmaceutical preparations is very reprehensible.

Products Resulting from the Natural Decomposition of Cellulose and Lignin and Their Derivatives

Coal is fossil fuel, which is found in the earth at various depths, and which has been formed by the decomposition of the cellulose, lignin, and other constituents of vegetable matter under the changing influences of moisture, temperature, and pressure to which it is subjected. The differences in the structure and composition of coal are undoubtedly due to the variations in these influences, as well as to the alterations in the character of the vegetable substances.

Coal Tar.—Many valuable compounds have been contributed by recent researches to the arts and medicine from this formerly useless by-product. Coal tar which is now official in the N.F. under the title Pix Lithanthracis (see page 995) is a residue left after the dry distillation of bituminous coal in the process for making illuminating gas (see page 122). It is a very complex substance; its composition varies considerably with the temperature at which the distillation of the coal is effected, the yield of solid bodies and of gases being larger when the temperature is higher, while at a lower temperature the liquid portion of the tar is increased in amount. When coal tar is submitted to distillation and rectification, it yields a brown, oily liquid, known technically as *light oil,* and consisting of benzene, toluene, etc.; then a black liquid, *dead oil,* is obtained, which contains aniline, naphthalene, phenol, etc.; the residue in the still is pitch, sometimes called *asphalt.* New products are continually being discovered; the principal constituents may be arranged in three classes.

1. *Solids.*—Naphthalene, $C_{10}H_8$; methyl-naphthalene, $C_{11}H_{10}$; acetyl-naphthalene and acenaphthene, $C_{12}H_{10}$; fluorene, $C_{13}H_{10}$; anthracene and phenanthrene, $C_{14}H_{10}$; pseudophenanthrene, $C_{16}H_{12}$; fluoranthene, $C_{15}H_{10}$; methyl-anthracene, $C_{15}H_{12}$; retene, $C_{18}H_{18}$; chrysene, $C_{18}H_{12}$; pyrene, $C_{16}H_{10}$; picene, $C_{22}H_{14}$; benzerythrene, $C_{24}H_{18}$; and carbazol, $C_{16}H_{11}N$.

2. *Liquids.*—These may be neutral hydrocarbons, acids, and ethers of the same, or bases. The *neutral hydrocarbons* are benzene, C_6H_6; toluene, C_7H_8; methyl-toluene and iso-xylol, C_8H_{10}; pseudocumol and mesitylene, C_9H_{12}; and cymol, $C_{10}H_{14}$. The *acid constituents* are phenol, C_6H_6O; cresol; orthocresol, paracresol, and metacresol, C_7H_8O; phlorol, $C_8H_{10}O$; rosolic acid, $C_{20}H_{16}O_3$; pyrocatechin, $C_6H_6O_2$; and creosote, consisting of the methyl ethers of pyrocatechin and its homologues, $C_7H_8O_2$, $C_8H_{10}O_2$, and $C_9H_{12}O_2$. There are also present, probably in combination with the ammonia of the ammoniacal liquor, acetic, butyric, carbonic, hydrocyanic, sulphocyanic, and hydrosulphuric acids. The *bases* are ammonia, NH_3; methylamine, CH_3NH_2; ethylamine, $C_2H_5NH_2$; phenylamine, $C_6H_5NH_2$; pyridine, C_5H_5N; picoline, C_6H_8N; lutidine, C_7H_9N; collidine, $C_8H_{11}N$; leucoline, C_9H_7N; iridoline, $C_{10}H_9N$; cryptidine, $C_{11}H_{11}N$; acridine, $C_{13}H_9N$; coridine, $C_{10}H_{15}N$; rubidine, $C_{11}H_{17}N$; and viridine, $C_{12}H_{19}N$.

3. *Gases.*—(*a*) *Illuminating gases.* Acetylene, C_2H_2; ethylene, C_2H_4; propylene, C_3H_6; butylene, C_4H_8; allylene, C_3H_4; crotonylene, C_4H_6; terene, C_5H_8; and vapors of benzene, C_6H_6; strolene, C_8H_8; naphthalene, $C_{10}H_8$; methyl-naphthalene, $C_{11}H_{10}$; fluorene, $C_{13}H_{10}$; fluoranthene, $C_{15}H_{10}$; propyl, $(C_3H_7)_2$; and butyl, $(C_4H_9)_2$.

(*b*) *Heating and diluting gases.* Hydrogen, H_2; marsh-gas (methane), CH_4; and carbon monoxide, CO.

(*c*) *Impurities.* Carbon dioxide, CO_2; ammonia, NH_3; cyanogen, $(CN)_2$; methyl-cyanide, CH_3CN; sulphocyanic acid, CNSH; hydrogen sulphide, H_2S; carbon disulphide, CS_2; carbon oxysulphide, COS; and nitrogen, N_2.

PIX LITHANTHRACIS. N. F. **Coal Tar**

[**Pix Lith.**—Pix Carbonis]

The tar obtained as a by-product in the destructive distillation of coal in the manufacture of illuminating gas.

Official Description.—A nearly black, thick liquid or semi-solid, heavier than water.

Odor and Taste.—Possessing a characteristic, naphthalene-like odor and a sharp burning taste.

Solubility and Reaction.—It is only slightly soluble in water, to which it imparts its characteristic odor and taste and a faintly alkaline reaction. It is but partially dissolved by alcohol, acetone, methyl alcohol, or purified petroleum benzin; almost entirely dissolved by ether; entirely dissolved by benzene, carbon disulphide, or chloroform.

Tests for Identity and Impurities.—On ignition it burns with a reddish, luminous and very sooty flame and upon strong heating is almost entirely consumed, leaving not more than 2 per cent. of ash.

N. F. Preparation.—Liquor Picis Carbonis.

Uses.—Used pharmaceutically only in the preparation of the solution (see below).

LIQUOR PICIS CARBONIS. N. F. Coal Tar Solution

[Liq. Pic. Carbon.]

	Metric	Old form
Coal Tar..................................	**200 Gm.**	**6 oz. av. 296 gr.**
Quillaja, in No. 20 powder	**100 Gm.**	**3 oz. av. 148 gr.**
Alcohol, a sufficient quantity,		
To make.............................	**1000 mils**	**2 pints**

Mix the coal tar and quillaja with 700 mils [old form about 22 fl. oz.] of alcohol and macerate the mixture during seven days in a closed vessel, with occasional agitation. Then filter and wash the contents of the filter with sufficient alcohol to make the product measure 1000 mils [old form 2 pints].

Uses.—This preparation, often called *Liquor carbonis detergens,* is employed externally in the treatment of chronic skin diseases.

BETANAPHTHOL. U. S. Betanaphthol

[Betanaph.—NAPHTHOL]

A monohydroxyphenol [$C_{10}H_7OH = 144.06$] of the naphthalene series. Preserve it in well-closed containers, protected from light.

Preparation.—When naphthalene is digested with fuming sulphuric acid, two acids may be obtained; at a temperature of 80° to 90° C. (176° to 194° F.) alphanaphthalene sulphonic acid is chiefly formed, but at 200° C. (392° F.) the beta variety is the principal product, and when this latter acid is fused with an alkali hydroxide and hydrochloric acid added, the official compound, betanaphthol, is liberated.

Official Description.—In colorless or pale buff-colored, shining crystalline laminæ, or a white or yellowish-white, crystalline powder. Permanent in the air.

Odor, Taste, and Reaction.—It has a faint, phenol-like odor and a pungent taste. A hot, saturated aqueous solution of Betanaphthol is neutral to litmus.

Solubility.—One Gm. of Betanaphthol dissolves in about 1000 mils of water, 0.8 mil of alcohol, 17 mils of chloroform and in 1.3 mils of ether at 25° C. (77° F.); also in 80 mils of boiling water; soluble in glycerin and olive oil and easily dissolved by alkali hydroxide solutions.

Tests for Identity.—Betanaphthol melts between 120° and 122° C. (248° and 251.6° F.).

Betanaphthol sublimes readily when heated and volatilizes with the vapors of alcohol or water.

A cold, saturated aqueous solution of Betanaphthol, when mixed with ammonia water, exhibits a faint, bluish fluorescence.

Add about 0.1 Gm. of Betanaphthol to 5 mils of an aqueous solution of potassium hydroxide (1 in 4), then add 1 mil of chloroform, and gently warm the mixture; the aqueous layer acquires a blue color, changing afterwards to green and brown.

Ferric chloride T.S. colors a cold, saturated solution of Betanaphthol greenish, and after some time causes the separation of whitish flakes, which turn brown upon the application of heat.

Impurities and Tests for Impurities.—Incinerate about 2 Gm. of Betanaphthol; not more than 0.05 per cent. of ash remains.

Naphthalene.—Dissolve 0.5 Gm. of Betanaphthol in 25 mils of ammonia water; no residue remains.

Other Organic Impurities.—And the solution does not have a deeper color than pale yellow.

Alphanaphthol.—A cold, saturated aqueous solution of Betanaphthol, on the addition of a few drops of iodine T.S., followed by sodium hydroxide T.S. in excess, shows no violet color.

N. F. Preparations.—Liquor Zinci et Alumini Compositus; Liquor Zinci et Ferri Compositus; Pasta Betanaphtholis; Petroxolinum Betanaphtholis.

Uses.—Betanaphthol is used as an antiseptic in skin diseases. It retards the growth of bacteria, and has been given internally in doses of three to five grains (0.2 to 0.3 Gm.).

CRESOL. U. S. Cresol

A mixture of isomeric cresols [C_7H_8O or $C_6H_4.CH_3.OH = 108.06$] obtained from coal tar. Preserve it in well-closed containers protected from light.

Preparation.—Soon after the introduction of carbolic acid (phenol) into use as an antiseptic it was discovered that some of the homologous constituents of *crude carbolic acid* were more active than the phenol which it contained. Cresol or *cresylic acid,* as it was then called, was the most important among these, and experience has developed its value. Official cresol consists of a mixture of three isomers existing according to Schulze in coal tar approximately in the proportion of 40 per cent. of *metacresol,* 35 per cent. of *orthocresol,* and 25 per cent. of *paracresol.* Cresol has a higher boiling point than phenol and is separated from it by fractional distillation.

Preparations of this type are frequently required to have stated upon the label their germicidal activity as compared with phenol. This figure is known as the *Phenol Coefficient* (see *Phenol*).

Official Description.—A colorless or yellowish to brown-yellow, highly refractive liquid, becoming darker or assuming a reddish tint with age and on exposure to light.

Reaction and Identity Test.—It has a phenol-like, sometimes empyreumatic odor. A saturated aqueous solution of Cresol is neutral or slightly acid to litmus, and becomes blue-violet on the addition of ferric chloride T.S.

Solubility.—One mil of Cresol dissolves in about 50 mils of water, usually forming a cloudy solution; it is miscible with alcohol, ether, benzene, petroleum benzin, or glycerin; it is dissolved by solutions of the fixed alkali hydroxides.

Specific Gravity.—1.030 to 1.038 at 25° C. (77° F.).

Impurities and Tests for Impurities.—Not less than 90 per cent. by volume of Cresol distils between 195° and 205° C. (383° and 401° F.).

Hydrocarbons.—A solution of 1 mil of Cresol in 60 mils of water is not more than slightly turbid.

Uses.—Cresol is antiseptic and resembles phenol in its medical properties, but owing to its greater insolubility in water is nearly always employed in combination with alkalies associated with fatty bodies, or soaps. (See Liquor Cresolis Compositus below). The dose is one to five minims (0.05 to 0.3 mil).

LIQUOR CRESOLIS COMPOSITUS. U. S. Compound Solution of Cresol

[Liq. Cresol. Co.]

	Metric	Old form
***Cresol**	**500 Gm.**	16 oz. av.
Linseed Oil	**300 Gm.**	9 oz. av. 263 gr.
Potassium Hydroxide	**80 Gm.**	2 oz. av. 245 gr.
Alcohol	**30 mils**	1 fl. oz.
Water, a sufficient quantity,		
To make	**1000 Gm.**	32 oz. av.

Heat the linseed oil in a tared vessel of a capacity equal to about four times the bulk of the ingredients, on a water bath to a temperature of 70° C. (158° F.). Dissolve the potassium hydroxide in 50 mils [old form about 1 fl. oz. 5 fl. dr.] of water and warm the solution to 70° C. (158° F.), add it to the linseed oil and mix thoroughly; then incorporate the alcohol and continue to heat the mixture without stirring until a small portion is found to be soluble in boiling water without the separation of oily drops. While yet warm add the cresol and mix thoroughly, maintaining the temperature at about 70° C. (158° F.) until a clear solution is produced. Finally add sufficient water to make the finished product weigh 1000 Gm. [old form 32 oz. av.].

NOTE.—In this process the 80 Gm. [old form 2 oz. av. 263 grains] of potassium hydroxide may be replaced by 54 Gm. [old form 1 oz. av. 319 gr.] of sodium hydroxide.

This liquid was introduced into the Pharmacopœia to supply a need for an antiseptic solution, which will readily mix with water; it closely resembles *lysol*, *creolin*, *solveol*, and *solutol* in its medical uses. Some of these preparations produce a milky mixture when added to water, due to the presence of rosin soap instead of an olein soap. Creolin is a preparation of this type, usually employed in from 1 to 3 per cent. aqueous solutions. Compound Solution of Cresol must be used with caution as it is about equal to phenol in its poisonous character.

The U. S. P. has permitted the alternative use of sodium hydroxide which produces a preparation practically identical in character with that made from potassium hydroxide and at a greatly reduced cost. It has been suggested that the pharmacist may readily prepare this solution by dissolving a corresponding weight of linseed oil-soft soap in the cresol and add sufficient water to make the required quantity. This has been found to be satisfactory if the soap is carefully selected.

Similar preparations are extensively used as a "*sheep dip*" for the destruction of parasitic organisms in the wool of sheep. A typical formula is as follows: Soap 1 lb. av., crude cresol 16 fl. oz., water to make 50 gallons.

Uses.—Compound solution of cresol is a valuable antiseptic solution for local applications. It is sometimes used internally in doses of five to ten minims (0.3 to 0.6 mil).

PHENOL. U. S. Phenol

[CARBOLIC ACID]

Hydroxybenzene obtained from coal tar or made synthetically. It contains not less than 97 per cent. of C_6H_5OH (94.05). Preserve it in well-closed containers, protected from light.

Preparation.—This valuable product is properly termed phenol, and it belongs to a well-marked class of hydrocarbons of which it is the type. Until recent years it was always made by distilling crude carbolic acid, and separating and purifying the distillate by repeated crystallizations, but it is now prepared synthetically by treating benzene or benzol with fuming sulphuric acid to produce benzene sulphonic acid as follows:

$$\underset{\text{Benzene}}{C_6H_6} + \underset{\substack{\text{Sulphuric}\\ \text{Acid}}}{H_2SO_4} = \underset{\substack{\text{Benzene-Sulphonic}\\ \text{Acid}}}{C_6H_5SO_2OH} + \underset{\text{Water}}{H_2O}$$

This acid is now neutralized with sodium carbonate, forming sodium benzene-sulphonate

$$\underset{\substack{\text{Benzene-Sulphonic}\\ \text{Acid}}}{2(C_6H_5SO_2OH)} + \underset{\substack{\text{Sodium}\\ \text{Carbonate}}}{Na_2CO_3} = \underset{\substack{\text{Sodium Benzene-}\\ \text{Sulphonate}}}{2(C_6H_5SO_2ONa)} + \underset{\substack{\text{Carbon}\\ \text{Dioxide}}}{CO_2} + \underset{\text{Water}}{H_2O}$$

The sodium benzene sulphonate is fused with caustic soda, whereby sodium phenolate and sodium sulphite are formed as follows:

$$\underset{\substack{\text{Sodium}\\ \text{Benzene-sulphonate}}}{2(C_6H_5SO_2ONa)} + \underset{\substack{\text{Sodium}\\ \text{Hydroxide}}}{4NaOH} = \underset{\text{Water}}{2H_2O} + \underset{\substack{\text{Sodium}\\ \text{Sulphite}}}{2Na_2SO_3} + \underset{\substack{\text{Sodium}\\ \text{Phenolate}}}{2C_6H_5ONa}$$

Hydrochloric acid is finally added to the sodium phenolate, which liberates phenol, which is further purified by distillation. The last reaction is as follows:

$$\underset{\substack{\text{Sodium}\\ \text{Phenolate}}}{C_6H_5ONa} + \underset{\substack{\text{Hydrochloric}\\ \text{Acid}}}{HCl} = \underset{\text{Phenol}}{C_6H_5OH} + \underset{\substack{\text{Sodium}\\ \text{Chloride}}}{NaCl}$$

When perfectly pure, phenol is devoid of the odor of cresol, but it has a peculiar aromatic odor, which is not disagreeable. Crystallized phenol, as found commercially, is much purer than the liquid forms, and has the advantage that it may be transported in cans or bottles without risk of loss by leakage. (See Phenol Liquefactum, page 1000).

Official Description.—It occurs in colorless, interlaced, or separate needle-shaped crystals, or as a white, crystalline mass, sometimes acquiring a red tint. When undiluted it cauterizes and whitens the skin and mucous membrane.

Odor and Reaction.—A characteristic, somewhat aromatic odor. An aqueous solution of phenol (1 in 15) is clear and neutral or at most only faintly acid to litmus.

Solubility.—One Gm. of Phenol dissolves in about 15 mils of water at 25° C. (77° F.); very soluble in alcohol, glycerin, chloroform, ether, carbon disulphide, or in fixed or volatile oils.

Tests for Identity and Impurities.—When gently heated Phenol melts, forming a highly refractive liquid. It is also liquefied by the addition of about 8 per cent. of water.

Congealing point: not below 38° C. (100.4° F.).

Its aqueous solution yields with bromine water a white precipitate of tribromphenol, which at first redissolves, but becomes permanent as more of the reagent is added, and appears crystalline when viewed under the microscope.

Add 1 drop of ferric chloride T.S. to 10 mils of an aqueous solution of Phenol (1 in 100); the liquid acquires a violet-blue color.

Heat about 10 Gm. of Phenol on a water bath; it is volatilized without leaving more than 0.05 per cent. of residue. The vapor is inflammable.

Assay.—Dissolve about 1.5 Gm. of the Phenol to be assayed, accurately weighed, in sufficient distilled water to make 1000 mils. Transfer an aliquot portion of this solution, containing not less than 0.038 Gm. nor more than 0.041 Gm. of Phenol, to a 500 mil glass-stoppered flask having a long, narrow neck, add 30 mils of tenth-normal bromine V.S., then 5 mils of hydrochloric acid and immediately insert the stopper. Shake the flask repeatedly during half an hour, allow it to stand for fifteen minutes, remove the stopper just sufficiently to introduce quickly 5 mils of an aqueous solution of potassium iodide (1 in 5), being careful that no bromine vapor escapes, and at once stopper the flask. Shake the latter thoroughly, remove the stopper and rinse it and the neck of the flask with a little distilled water, so that the washings may flow into the flask, then add 1 mil of chloroform, shake the mixture well and titrate with tenth-normal sodium thiosulphate V.S., using starch T.S. as indicator. It shows not less than 97 per cent. of C_6H_5OH. Each mil of tenth-normal bromine V.S. corresponds to 0.001568 Gm. of C_6H_5OH. Each gramme of Phenol corresponds to not less than 618.6 mils of tenth-normal bromine V.S.

U. S. P. Preparations.—Glyceritum Phenolis (from Liquefied Phenol); Phenol Liquefactum; Unguentum Phenolis (from Liquefied Phenol).

N. F. Preparations.—Aqua Phenolata (from Liquefied Phenol); Liquor Iodi Phenolatus (from Liquefied Phenol); Liquor Sodii Boratis Compositus (from Liquefied Phenol); Nebula Aromatica; Oleum Phenolatum; Petroxolinum Phenolis; Petroxolinum Phenolis Camphoratum; Phenolum Iodatum; Pulvis Antisepticus.

Uses.—Phenol is unquestionably the most largely used antiseptic, and because of this fact great caution must be observed in dispensing it, as it is employed more frequently for suicidal purposes than any other poison; when applied to the skin or mucous membrane, it cauterizes and produces blanching; alcohol applied at once to the cauterized part causes the disappearance of the white spots. Alcohol has been used successfully in the treatment of poisoning by "carbolic acid" after it has been swallowed; the stomach pump should also be employed, as vomiting is rendered almost impossible owing to the benumbing influence of the poison. When diluted with an equal volume of glycerin, it becomes miscible with water in any proportion. One of the developments of the use of antiseptics has been the establishment of a method for determining the value of substances which possess the power to destroy micro-organisms. Phenol has been taken as the standard and other substances are rated in comparison with it by what is known as the *Phenol Coefficient.* The details of this test have been carefully developed, although no one method was sufficiently proved for adoption in the U. S. P. IX. They all depend, however, upon the killing of bacteria in a definite time and under carefully specified conditions as to temperature, presence of organic matter, time, etc., and the comparison is made against pure phenol. Many States and also various departments of the Government require a statement of the phenol coefficient, or value as compared with phenol, on the labels of preparations which claim to possess germicidal power. For further information see the Hygienic Laboratory Bulletin No. 82, April, 1912. The dose of phenol is one grain (0.065 Gm.).

PHENOL LIQUEFACTUM. U. S. Liquefied Phenol

[**Phenol Liq.**—LIQUEFIED CARBOLIC ACID]

A liquid containing not less than 87 per cent. of C_6H_5OH (94.05).

***Phenol,** a convenient quantity.
Distilled Water, a sufficient quantity.

Liquefy the phenol by placing the unstoppered container on a water bath, and applying heat gradually until the crystals have melted, transfer the liquid to a tared vessel and weigh it; then add for each 9 Gm. [old form 9 oz. av.] of phenol 1 Gm. [old form 1 oz. av.] of distilled water and mix thoroughly. Preserve it in well-closed containers, protected from light.

Official Description.—A colorless liquid, which may develop a red tint upon keeping. When undiluted it cauterizes and whitens the skin and mucous membrane.

Odor.—It has a characteristic, somewhat aromatic odor.

Miscibility.—Liquefied Phenol is miscible with alcohol, ether, or glycerin. When it is diluted with an equal volume of glycerin, the mixture is miscible with water.

Specific Gravity.—About 1.065 at 25° C. (77° F.).

Tests for Identity and Impurities.—When subjected to distillation, the boiling point does not rise above 182° C. (359.6° F.).

In other respects Liquefied Phenol responds to the tests for identity and purity under *Phenol* (omitting the congealing point).

Assay.—Proceed as directed under *Phenol.*

Each gramme of Liquefied Phenol corresponds to not less than 554.8 mils of tenth-normal bromine V.S.

U. S. P. Preparations.—Glyceritum Phenolis; Unguentum Phenolis.

N. F. Preparations.—Aqua Phenolata; Liquor Iodi Phenolatus; Liquor Sodii Boratis Compositus.

Uses.—Liquefied phenol was introduced into the Pharmacopœia to furnish a uniform and convenient method of using phenol in a concentrated liquid form, the practice of adding 10 per cent. of water to crystallized phenol has long been used, this liquid being often more convenient for compounding prescriptions than the crystals. In using it, allowance must of course be made for the presence of 10 per cent. of water. The dose is one minim (0.05 mil).

PHENOL IODATUM. N. F. Iodized Phenol

[**Phenol Iodat.**—Acidum Carbolicum Iodatum, N. F. III]

	Metric	Old form
Iodine, reduced to powder	20 Gm.	2 oz. av.
Phenol	60 Gm.	6 oz. av.
Glycerin	20 Gm.	2 oz. av.
To make	100 Gm.	10 oz. av.

Place the iodine in a flask, add the phenol, previously melted, then the glycerin, and digest the mixture at a gentle heat, frequently agitating, until the iodine is dissolved.

Preserve the product in glass-stoppered bottles in a dark place.

Uses.—It is used as an antiseptic and caustic.

PHENOLPHTHALEINUM. U. S. Phenolphthalein

[**Phenolphthal.**]

A dibasic phenol derivative (dihydroxyphthalophenone) [$C_{20}H_{14}O_4$ or $(C_6H_4OH)_2CO.C_6H_4CO = 318.11$].

Preparation.—It may be prepared by heating 10 parts of phenol with 5 parts of phthalic anhydride and 4 parts of sulphuric acid to 120° C. (248° F.), for ten or twelve hours, exhausting the product with boiling water, dissolving the residue in dilute sodium hydroxide solution, filtering and precipitating with acetic acid. It is afterwards purified and crystallized.

Official Description.—It is a white or faintly yellowish-white, crystalline powder; permanent in the air.

Odor and Taste.—Odorless and tasteless.

Solubility.—One Gm. of Phenolphthalein dissolves in 13 mils of alcohol, and in about 70 mils of ether at 25° C. (77° F.); almost insoluble in water.

Tests for Identity.—Melting point: not below 253° C. (487.4° F.).

It is dissolved by solutions of the alkali hydroxides and carbonates with a red color. The solutions are decolorized by the addition of acids in excess or by heating with zinc dust.

Impurities and Tests for Impurities.—Incinerate about 2 Gm. of Phenolphthalein; not more than 0.05 per cent. of ash remains.

A solution of 0.5 Gm. of Phenolphthalein in 30 mils of alcohol is colorless.

Fluorane.—One-half Gm. of Phenolphthalein dissolves completely in a mixture of 4 mils of sodium hydroxide T.S. and 50 mils of distilled water.

A mixture of 250 mils of cold, recently boiled, distilled water and 0.5 mil of a solution of Phenolphthalein (1 in 100) in diluted alcohol requires not more than 0.5 mil of hundredth-normal potassium hydroxide V.S. to produce a pink coloration.

Heavy Metals.—Heat about 0.5 Gm. of Phenolphthalein on a water bath for five minutes with 10 mils of diluted hydrochloric acid, filter the liquid and evaporate the filtrate to dryness; the residue, when dissolved in 25 mils of distilled water, slightly acidulated with hydrochloric acid, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Heat a crucible to redness and introduce, in small portions, an intimate mixture of 0.2 Gm. of Phenolphthalein, about 0.5 Gm. of potassium nitrate, and about 0.3 Gm. of anhydrous sodium carbonate. Maintain a red heat until the reaction ceases, then boil the cooled residue for five minutes with 10 mils of diluted sulphuric acid, filter, and wash the undissolved residue with 10 mils of distilled water. Evaporate the filtrate and washings until sulphuric acid vapors begin to evolve. The residue, dissolved in 5 mils of distilled water, meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

N. F. Preparation.—Trochisci Phenolphthaleini.

Uses.—Phenolphthalein has been used for a number of years as an indicator in volumetric analysis, but it is now largely employed internally as a purgative in doses of one to eight grains (0.065-0.5 Gm.).

TRINITROPHENOL. U. S. Trinitrophenol

[Trinitrophen.—PICRIC ACID]

Trinitrophenol [$C_6H_3O_7N_3$ or $C_6H_2(OH)(NO_2)_3$ 1:2:4:6 = 229.05]. Preserve it in well-stoppered bottles in a cool pace, remote from fire.

Caution.—For safety in transportation it is usually mixed with about 20 per cent. of water. Before applying the tests described below, dry the Trinitrophenol to constant weight in a desiccator over sulphuric acid.

Preparation.—It is obtained by the action of nitric acid on phenol.

Official Description.—It occurs in pale yellow, rhombic prisms or scales. It explodes when heated rapidly and when subjected to percussion.

Odor, Taste, and Reaction.—Odorless, and having an intensely bitter taste. An aqueous solution of Trinitrophenol is acid to litmus.

Solubility.—One Gm. of Trinitrophenol dissolves in 78 mils of water, 12 mils of alcohol, 35 mils of chloroform, 65 mils of ether, and in 10 mils of benzene at 25° C. (77° F.); also in 15 mils of boiling water.

Tests for Identity.—It melts between 121° and 123° C. (249.8° and 253.4° F.).

An aqueous solution of Trinitrophenol (1 in 100) has a yellow color, which becomes darker on the addition of alkalies, and red on the addition of ammonium sulphide T.S. or a solution of an alkaline cyanide.

Impurities and Tests for Impurities.—*Sulphate.*—Add a few drops of barium chloride T.S. to 10 mils of an aqueous solution of Trinitrophenol (1 in 100); the liquid does not at once become opalescent.

Dissolve 2 Gm. of Trinitrophenol in 50 mils of benzene, collect the insoluble residue, if any, on a small filter which has been dried at 100° C. (212° F.) and weighed. Wash the residue and filter with benzene until the washings are colorless. The residue, dried at 100° C. (212° F.), does not exceed 0.2 per cent.

Uses.—It is used chiefly in the form of a 1 per cent. aqueous solution for burns, although it is also used in urine analysis to detect and estimate glucose and also in the determination of albumin. It is very explosive when dry, therefore the above caution concerning transportation. It has been employed internally as an antipyretic; the dose is one-half grain (0.03 Gm).

RESORCINOL. U. S. Resorcinol

[Resorcin.—RESORCIN]

Metadihydroxybenzene. It contains not less than 99.5 per cent. of $C_6H_4(OH)_2$ 1:3 (110.05). Preserve it in well-closed containers, protected from light.

Preparation.—Resorcinol is usually prepared by fusing sodium metabenzenedisulphonate with sodium hydroxide; it may be made in several other ways—by the destructive distillation of brazilin, or by the fusion of either galbanum, ammoniac, sagapenum, asafetida, or acroides with caustic potash. Resorcinol is a diatomic phenol isomeric with *pyrocatechin* and *hydroquinone*.

Official Description.—It occurs in colorless, or nearly colorless, needle-shaped crystals or as a powder . It acquires a pink tint on exposure to light and air.

Odor, Taste, and Reaction.—It has a faint, peculiar odor and a sweetish, followed by a bitter, taste. Its aqueous solution (1 in 20) is neutral or only faintly acid to litmus.

Solubility.—One Gm. of Resorcinol dissolves in 0.9 mil of water and in 0.9 mil of alcohol at 25° C. (77° F.); also in about 0.2 mil of water at 80° C. (176° F.); freely soluble in glycerin or ether; slightly soluble in chloroform.

Tests for Identity and Impurities.—It melts between 109° and 111° C. (228.2° and 231.8° F.).

The addition of a few drops of ferric chloride T.S. to 10 mils of an aqueous solution of Resorcinol (1 in 200) produces a bluish-violet color, changing to brownish-yellow on the addition of ammonia water (distinction from *catechol and quinol*).

Dissolve 0.1 Gm. of Resorcinol in 1 mil of potassium hydroxide T.S. and then add a drop of chloroform; the mixture upon being heated assumes an intense, crimson color, and if a slight excess of hydrochloric acid is then added, the color changes to a pale straw-yellow.

Incinerate about 2 Gm. of Resorcinol; not more than 0.05 per cent. of ash remains.

Catechol.—Lead acetate T.S. produces no precipitate when added to an aqueous solution of Resorcinol (1 in 20).

An aqueous solution of Resorcinol (1 in 20) does not emit the odor of phenol when gently warmed.

Assay.—Dissolve about 1.5 Gm. of Resorcinol, accurately weighed, in sufficient distilled water to make 500 mils. Transfer 25 mils of the solution to a 500 mil, glass-stoppered flask having a long and narrow neck, add 50 mils of tenth-normal bromine V.S., and dilute with 50 mils of distilled water. Then add 5 mils of hydrochloric acid and at once stopper the flask. Shake the liquid and allow it to stand for one minute, then dilute it with 20 mils of distilled water, add 5 mils of potassium iodide T.S. and allow it to stand for five minutes. The titration of the liberated iodine with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator, shows not less than 99.5 per cent. of $C_6H_4(OH)_2$. Each mil of tenth-normal bromine V.S. corresponds to 0.001834 Gm. of $C_6H_4(OH)_2$. Each gramme of Resorcinol corresponds to not less than 542.5 mils of tenth-normal bromine V.S.

N. F. Preparations.—Pasta Resorcinolis Fortis; Pasta Resorcinolis Mitis; Unguentum Resorcinolis Compositum.

Uses.—Resorcinol is an antiseptic closely resembling phenol in its physiological action. It is used mainly externally in various skin diseases. The dose of resorcinol is two to three grains (0.12 to 0.2) Gm.).

ACIDUM SALICYLICUM. U. S. Salicylic Acid

[Acid. Salicyl.]

Orthohydroxybenzoic acid, existing naturally in combination in various plants, but generally prepared synthetically. It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99.3 per cent. of $C_7H_6O_3$ or $C_6H_4(OH)COOH$ (138.05). Preserve it in well-closed containers.

Preparation.—Although salicylic acid may be obtained from several natural sources, it is obtained, according to Kolbe's patent, by treating sodium phenol (or carbolate) with carbon dioxide. For this purpose, the most concentrated caustic soda solution is evaporated with the corresponding amount of phenol to a dry powder; this is then heated to 100° C. (212° F.), while a stream of dry carbon dioxide is passed over it. The temperature is gradually raised to 180° C. (356° F.), and increased to 220° C. (428°F.) as soon as phenol distils over, and finally raised to 250° C. (482° F.), until no more phenol distils. In the retort, the half of the phenol used remains as sodium salicylate, while the other half is distilled over unchanged. The reaction is as follows:

$$\underset{\text{Sodium Phenol}}{2NaC_6H_5O} + \underset{\text{Carbon Dioxide}}{CO_2} = \underset{\text{Phenol}}{C_6H_6O} + \underset{\text{Normal Sodium Salicylate}}{Na_2C_7H_4O_3}$$

The sodium salt thus obtained is dissolved in water, decomposed by hydrochloric acid, and the salicylic acid filtered off, washed, and crystallized from a hot aqueous solution, or purified by sublimation in a current of superheated steam or dialyzed.

Schmitt improved Kolbe's process by acting upon sodium phenol with carbon dioxide in closed vessels at a temperature of 130° C. (266° F.); sodium-phenol carbonate is formed which passes into sodium salicylate. By this modification no separation of phenol occurs. Salicylic acid is also made from oil of gaultheria by adding to it a strong solution of potassium hydroxide whereby potassium salicylate is formed; this is then poured into diluted hydrochloric acid and the separated crystals of salicylic acid purified by recrystallization.

Official Description, Odor, Taste, and Reaction.—It occurs in fine prismatic needles, or as a bulky, crystalline powder, having a sweetish, afterwards acrid taste; permanent in the air. Synthetic Salicylic Acid is white and odorless; when prepared from methyl salicylate the Acid may have a slightly yellow or pink tint and a slight, gaultheria-like odor. A saturated, aqueous solution of Salicylic Acid is acid to litmus.

Solubility.—One Gm. of Salicylic Acid dissolves in 460 mils of water, 2.7 mils of alcohol, 42 mils of chloroform, 3 mils of ether, 135 mils of benzene, or in 52 mils of oil of turpentine at 25° C. (77° F.); also in about 15 mils of boiling water.

Tests for Identity and Impurities.—It melts between 156° and 159° C. (312.8° and 318.2° F.).

A saturated, aqueous solution of Salicylic Acid is colored intensely bluish-violet (in high dilution violet-red) by ferric chloride T.S.

Incinerate about 1 Gm. of Salicylic Acid; not more than 0.1 per cent. of ash remains.

Iron, Phenol, or Coloring Matter.—Allow a saturated alcoholic solution of about 1 Gm. of Salicylic Acid to evaporate spontaneously, in a glass or porcelain dish in a place protected from dust; the synthetic Acid yields a perfectly white, crystalline residue; the Acid, prepared from methyl salicylate, yields a white, or not more than a slightly yellow, or slightly pink residue.

Dissolve about 1 Gm. of Salicylic Acid in an excess of cold sodium carbonate T.S., agitate the liquid with an equal volume of ether, and allow the ethereal solution to evaporate spontaneously; the residue, if any, is free from the odor of phenol.

Organic Impurities.—A solution of about 0.5 Gm. of the synthetic Salicylic Acid in 10 mils of sulphuric acid at room temperature acquires not more than a light yellow color. The Acid, prepared from methyl salicylate, under similar conditions, may produce a slightly brown color.

Hydrochloric Acid.—A solution of about 0.5 Gm. of Salicylic Acid in 10 mils of alcohol mixed with a few drops of nitric acid remains unaffected upon the addition of a few drops of silver nitrate T.S.

Assay.—Dissolve about 0.5 Gm. of Salicylic Acid, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed, in 25 mils of diluted alcohol which has previously been neutralized with tenth-normal potassium hydroxide V.S., phenolphthalein T.S. being used as indicator. Titrate this solution with tenth-normal barium hydroxide V.S., using phenolphthalein T.S. as indicator. It shows, in the dried acid, not less than 99.3 per cent. of $C_7H_6O_3$. Each mil of tenth-normal barium hydroxide V.S. corresponds to 0.013805 Gm. of $C_7H_6O_3$. Each gramme of Salicylic Acid, previously dried, corresponds to not less than 71.9 mils of tenth-normal barium hydroxide V.S.

N. F. Preparations.—Collodium Salicylici Compositum; Glycerogelatinum Acidi Salicylici; Mulla Creosoti Salicylata; Mulla Acidi Salicylici; Pasta Zinci; Pulvis Antisepticus; Pulvis Talci Compositus; Stili Acidi Salicylici Dilubilis.

Uses.—Salicylic acid is an important product. It is used as an antipyretic, in doses of seventy-five grains, given in divided doses until the temperature is lowered. Its principal use is in rheumatism and gout, the dose being eight grains (0.5 Gm.). A number of salts of the acid are official—ammonium, bismuth, eserine, mercuric, phenyl, quinine, strontium, sodium, and physostigmine salicylates; methyl salicylate is an official liquid. The sodium salt is very valuable, and is generally relied upon for the internal administration of the acid.

PHENYLIS SALICYLAS. U. S. Phenyl Salicylate

[**Phenyl. Salicyl.**—SALOL].

The phenyl ester [$C_{13}H_{10}O_3$ or $C_6H_4(OH)COOC_6H_5$ 1 : 2=214.08] of salicylic acid. Preserve it in well-closed containers in a cool place.

Preparation.—Phenyl salicylate is prepared by heating salicylic acid with phenol in the presence of certain acid chlorides (phosphoryl chloride or carbonyl chloride); the elements of water are withdrawn by this action, and the phenyl group is caused to unite with the salicylic radical.

Official Description.—A white, crystalline powder.

Odor, Taste, and Reaction.—It has an aromatic odor and a characteristic taste.

Solubility.—One Gm. of Phenyl Salicylate dissolves in 6670 mils of water and in 6 mils of alcohol at 25° C. (77° F.); very soluble in chloroform, ether, benzene, or in fixed or volatile oils.

Tests for Identity.—It melts between 41° and 43° C. (105.8° and 109.4° F.).

The addition of diluted ferric chloride T.S. to an alcoholic solution of the salt (1 in 20) produces a violet color.

Dissolve from 0.2 to 0.3 Gm. of Phenyl Salicylate in 2 mils of hot sodium hydroxide T.S., and acidify the solution with hydrochloric acid; salicylic acid separates and the odor of phenol is recognizable.

Impurities and Tests for Impurities.—Incinerate about 2 Gm. of Phenyl Salicylate; not more than 0.05 per cent. of ash remains.

Free Acids.—Phenyl Salicylate does not redden moistened blue litmus paper.

Uncombined Phenol or Salicylic Acid.—Shake about 1 Gm. of Phenyl Salicylate with 50 mils of distilled water and filter the liquid; the addition of 1 drop of ferric chloride T.S. to 10 mils of the filtrate produces no violet color.

Sulphate or Chloride.—Ten mil portions of the same filtrate tested separately with barium nitrate T.S. and silver nitrate T.S. show no turbidity.

Uses.—Phenyl salicylate is used as an intestinal antiseptic, it being decomposed in the small intestine, when in contact with alkaline fluids, into phenol and salicylic acid. It is also used pharmaceutically to coat pills by rolling them in the salol, fused at a low temperature, forming what are termed *enteric pills,* for intestinal administration, the salol being insoluble in the stomach. The dose is from five to thirty grains (0.3 to 2 Gm.).

ACETPHENETIDINUM. U. S. Acetphenetidin

[**Acetphen.**—PHENACETIN]

The monoacetyl derivative [$C_{10}H_{13}O_2N$ or $C_6H_4(OC_2H_5).NH.CH_3CO$ 1 : 4=179.11] of para-amidophenetol.

Preparation.—Acetphenetidin is made by treating paraphenetidin $C_6H_4(NH_2)\,OC_2H_5$ with glacial acetic acid, which introduces the acetyl group, and acetparaphenetidin ($C_6H_4(NHC_2H_3O)OC_2H_5$ is formed.

Official Description.—It occurs in white, glistening, crystalline scales or as a fine crystalline powder; permanent in the air.

Odor, Taste, and Reaction.—Odorless, having a slightly bitter taste and producing a faint numbing effect on the tongue. Its saturated aqueous solution is neutral to litmus.

Solubility.—One Gm. of Acetphenetidin dissolves in 1310 mils of water, 15 mils of alcohol, 14 mils of chloroform, and in 90 mils of ether at 25° C. (77° F.); also in 82 mils of boiling water and 2.8 mils of boiling alcohol.

Tests for Identity.—Acetphenetidin melts between 133° and 135° C. (271.4° and 275° F.).

Boil about 0.1 Gm. of Acetphenetidin for one minute with 1 mil of hydrochloric acid, dilute the mixture with 10 mils of distilled water, cool, and filter it; a drop of potassium dichromate T.S. added to the filtrate produces a ruby-red color.

Impurities and Tests for Impurities.—Incinerate about 2 Gm. of Acetphenetidin; not more than 0.05 per cent. of ash remains.

Readily Carbonizable Impurities.—A mixture of about 0.005 Gm. of Acetphenetidin and 1 mil of nitric acid is colored yellow, the color becoming darker on standing. The solution of about 0.5 Gm. of Acetphenetidin in 5 mils of colorless sulphuric acid is not more than faintly yellow.

Acetanilid.—Boil about 0.1 Gm. of Acetphenetidin with 10 mils of distilled water until dissolved, cool the solution, filter it, and add bromine T.S. to the filtrate, drop by drop, with agitation after each addition, until the solution remains permanently yellow; neither turbidity nor precipitation is produced.

Para-phenetidin.—A mixture of about 0.3 Gm. of Acetphenetidin with 1 mil of alcohol and 1 drop of tenth-normal iodine V.S. does not acquire a red tint when diluted with three times its volume of distilled water and boiled.

Uses.—Acetphenetidin, or *phenacetin*, is a valuable antipyretic and analgesic; the absence of paraphenetidin in the product should be assured; the dose is from five to fifteen grains (0.3 to 1 Gm.).

METHYLTHIONINÆ CHLORIDUM. U. S. Methylthionine Chloride

[**Methylthionin. Chlor.**—METHYLTHIONINÆ HYDROCHLORIDUM, U. S. P. VIII
METHYLENE BLUE]

Tetramethylthionine chloride [$C_{16}H_{18}N_3ClS+3H_2O=373.75$].

Preparation.—It is made by treating an acid solution of dimethyl-paraphenylene diamine with hydrogen sulphide and ferric chloride.

Official Description.—It occurs as a dark green, crystalline powder, or in prismatic crystals having a lustre resembling bronze.

Solubility.—Methylthionine Chloride is freely soluble in water and alcohol; soluble in chloroform; the solutions have a deep blue color.

Tests for Identity.—The addition of hydrochloric acid to its aqueous solution changes the color to a lighter shade of blue.

The addition of sodium hydroxide T.S. to its aqueous solution changes the color to a purplish shade, and, if added in excess, produces on standing a precipitate having a dull violet color.

A solution of Methylthionine Chloride in diluted sulphuric acid is gradually decolorized upon the addition of zinc dust.

Impurities and Tests for Impurities.—Incinerate about 0.5 Gm. of Methylthionine Chloride; not more than 1 per cent. of ash remains.

Arsenic.—Intimately mix 0.2 Gm. of Methylthionine Chloride with about 0.5 Gm. each of potassium nitrate and anhydrous sodium carbonate and heat the powdered mixture in a crucible until the organic matter is completely oxidized. Then dissolve the cooled residue in 15 mils of diluted sulphuric acid and evaporate the solution over a flame until vapors of sulphuric acid begin to evolve. The residue so obtained meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Zinc.—Heat about 0.5 Gm. of Methylthionine Chloride at a temperature below a red heat until it is completely carbonized, boil the powdered residue with 10 mils of diluted hydrochloric acid for five minutes, filter the liquid and wash the residue with 10 mils of distilled water. The combined liquids, when boiled with 1 mil of nitric acid, and supersaturated with ammonia water and filtered, if necessary, remain clear upon the addition of an equal volume of hydrogen sulphide T.S.

Dextrin.—Dissolve 1 Gm. of Methylthionine Chloride in 50 mils of boiling alcohol, filter through counter-balanced filters, wash the residue on the filter with boiling alcohol until the washings cease to be colored blue, and dry it at 100° C. (212° F.). The weight corresponds to not more than 1 per cent.

Uses.—Methylene blue, as it is usually called, is used in rheumatic affections and in gonorrhœa. Its intense and persistent color makes it a difficult substance to dispense easily. It is administered most satisfactorily in capsules, in doses of two to four grains (0.13–0.25 Gm.).

ACETANILIDUM. U. S. Acetanilid

[**Acetanil.**—ACETANILIDE ANTIFEBRIN

The monoacetyl derivative [C_8H_9ON or $C_6H_5NH.CH_3CO = 135.08$] of aniline.

Preparation.—Acetanilid or *antifebrin*, is made by heating a mixture of aniline and glacial acetic acid to the boiling point; the cooled, congealed residue is purified by sublimation or recrystallization.

Official Description.—It occurs in colorless, shining, micaceous, crystalline laminæ or as a crystalline powder; permanent in the air.

Odor, Taste, and Reaction.—Odorless, having a slightly burning taste. Its saturated aqueous solution is neutral to litmus.

Solubility.—One Gm. of Acetanilid dissolves in 190 mils of water, 3.4 mils of alcohol, 3.7 mils of chloroform, 17 mils of ether, 47 mils of benzene, and in about 5 mils of glycerin at 25° C. (77° F.); also in 20 mils of boiling water and in 0.6 mil of boiling alcohol.

Tests for Identity.—Acetanilid melts between 112° and 114° C. (233.6° and 237.2° F.).

Boil about 0.1 Gm. of Acetanilid with 5 mils of potassium hydroxide T.S.; the characteristic odor of aniline becomes noticeable. Now add 1 mil of chloroform, and again heat the mixture; the disagreeable odor of phenylisocyanide (a poisonous substance) is evolved.

Boil about 0.1 Gm. of Acetanilid for several minutes with 2 mils of hydrochloric acid; a clear solution results, which, when mixed with 3 mils of an aqueous solution of phenol (1 in 20) and afterwards with 5 mils of a filtered, saturated solution of chlorinated lime, acquires a brownish-red color, which becomes deep blue upon supersaturation with ammonia water.

Bromine T.S. produces a white, crystalline precipitate in an aqueous solution of Acetanilid.

Impurities and Tests for Impurities.—Incinerate about 2 Gm. of Acetanilid; not more than 0.05 per cent. of ash remains.

Readily Carbonizable Impurities.—The solution of about 0.5 Gm. of Acetanilid in 5 mils of colorless sulphuric acid is not more than faintly yellow.

Aniline Salts or Other Allied Substances.—Add 5 drops of ferric chloride T.S. to 5 mils of a cold, saturated aqueous solution of Acetanilid; the color does not differ from that produced by adding 5 drops of ferric chloride T.S. to 5 mils of distilled water.

N. F. Preparation.—Pulvis Acetanilidi Compositus.

Uses.—Acetanilid is an antipyretic, reducing temperature, and in moderate doses producing diaphoresis. When in very fine powder, it is used as an antiseptic application to burns, wounds, ulcers, etc. It is largely employed in popular headache remedies, but it should always be used with caution. The dose is from three to ten grains (0.2 to 0.6 Gm.).

ANTIPYRINA. U. S. Antipyrine

[**Antipyr.**—PHENAZONE]

Phenyldimethylpyrazolon [$C_{11}H_{12}ON_2$ or $C_3HON_2(CH_3)_2.C_6H_5 = 188.12$]. Preserve it in well-closed containers.

Preparation.—Antipyrine is made by Knorr's process by acting on phenylhydrazine with aceto-acetic ether when phenylmethylpyrazolon is formed; this is methylated by treatment with methyl-iodide, resulting in the formation of phenyldimethylpyrazolon or antipyrine.

Official Description.—It occurs as a white, crystalline powder or in tabular crystals.

Odor, Taste, and Reaction.—Almost odorless but with a slightly bitter taste. Its aqueous solution (1 in 20) is neutral to litmus.

Solubility.—One Gm. of Antipyrine dissolves in less than 1 mil of water, in 1.3 mils of alcohol, 1 mil of chloroform, and in 43 mils of ether, at 25° C. (77° F.).

Tests for Identity.—It melts between 111° and 113° C. (231.8° and 235.4° F.).

The addition of tannic acid T.S. to an aqueous solution of Antipyrine produces an abundant white precipitate.

Mix 0.1 Gm. of sodium nitrite and 12 mils of an aqueous solution of Antipyrine (1 in 100); a nearly colorless liquid is obtained, which, upon the addition of 1 mil of diluted sulphuric acid, develops a deep green color due to the formation of isonitroso-antipyrine.

One drop of ferric chloride T.S. added to 2 mils of a dilute aqueous solution of Antipyrine (1 in 1000) produces a deep red color, which, upon the addition of 10 drops of sulphuric acid, is changed to light yellow.

Impurities and Tests for Impurities.—Incinerate about 1 Gm. of Antipyrine; not more than 0.1 per cent. of ash remains.

Antipyrine is completely soluble in 1 part of cold distilled water, the solution being colorless or at most slightly yellow when viewed crosswise in a test tube of about 20 mm. in diameter.

Heavy Metals.—An aqueous solution of Antipyrine does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Uses.—Antipyrine was one of the first of the modern antipyretics and analgesics to come into successful use; it has been largely superseded by other antipyretics, mainly on account of its dangerous action upon the heart, even when given in moderate doses. The dose is five grains (0.3 Gm.).

BENZOSULPHINIDUM. U. S. Benzosulphinide

[**Benzosulphinid.**—SACCHARIN GLUSIDUM]

The anhydride [$C_7H_5O_3NS$ or $C_6H_4SO_2.CONH = 183.12$] of ortho-sulphamide-benzoic acid.

Saccharin, as it is commercially named, is made from the coal tar product, toluene, by converting it into toluene-sulphonic chloride. This is treated with ammonia, whereby the sulphamide is formed, which by oxidation is converted into the sulphinide, saccharin being the anhydride of ortho-sulphamide-benzoic acid. The official name (benzosulphinide) is a contraction, but it is probable that the name saccharin will always be used. The soluble form which is a sodium salt, is also official (see page 748).

Official Description.—It occurs as white crystals or as a white, crystalline powder.

Odor, Taste, and Reaction.—Odorless, or having a faint, aromatic odor; its solutions have an intensely sweet taste. A saturated aqueous solution of Benzosulphinide is acid to litmus.

Solubility.—One Gm. of Benzosulphinide dissolves in 290 mils of water and in 31 mils of alcohol at 25° C. (77° F.); also in about 25 mils of boiling water; slightly soluble in chloroform or ether. It is easily dissolved by ammonia water, by alkali hydroxide solutions, also by a solution of sodium bicarbonate, with the evolution of carbon dioxide.

Tests for Identity and Purity.—It melts between 219° and 222° C. (426.2° and 431.6° F.).

When Benzosulphinide is fused at a low temperature with about 5 times its weight of sodium hydroxide, ammonia vapors are evolved; continue the heating until the evolution of ammonia has ceased, treat the residue with 10 mils of distilled water, neutralize the solution with diluted hydrochloric acid, and filter; the filtrate becomes violet on the addition of a drop of ferric chloride T.S.

Incinerate about 1 Gm. of Benzosulphide; not more than 0.5 per cent. of ash remains.

Impurities and Tests for Impurities.—*Carbonizable Impurities.*—A solution of 0.2 Gm. of Benzosulphinide in 10 mils of sulphuric acid kept at a temperature of from 48° to 50° C. (118.4° to 122° F.), on a water bath, develops not more than a brown color within ten minutes.

Glucose, Milk-Sugar.—A solution of about 0.2 Gm. of Benzosulphinide in 5 mils of potassium hydroxide T.S. remains clear, and, when mixed with 5 mils of alkaline cupric tartrate V.S., does not deposit cuprous oxide on heating.

Benzoic or Salicylic Acid.—Add ferric chloride T.S., drop by drop, to 10 mils of a hot, saturated aqueous solution of Benzosulphinide; no precipitate nor violet color appears.

An aqueous solution of Benzosulphinide (1 in 10,000) has a distinctly sweet taste, comparable with that of an aqueous solution of sugar (1 in 20).

Ammonium Compounds.—No odor of ammonia is noticeable on warming about 0.5 Gm. of Benzosulphinide with about 1 Gm. of magnesia and 10 mils of distilled water.

U. S. P. Preparation.—Fluidextractum Cascaræ Sagradæ Aromaticum.

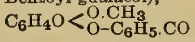
N. F. Preparation.—Oleum Ricini Aromaticum.

Uses.—Benzosulphinide is used for sweetening, but the Food and Drugs Act and most State food laws prohibit its use in foods and beverages. It has five hundred times the sweetening power of sugar. It is given in diabetes, but its use is not without some danger. The dose is three grains (0.2 Gm.).

Unofficial Products Obtained from Coal Tar and Allied Substances

Acetbromanilid, Antisepsin, $C_6H_4Br.NH(C_2H_3O)$	Prepared by adding 160 parts bromine to a solution of 135 parts of acetanilid in glacial acetic acid, and crystallizing the precipitate from hot alcohol. Colorless needles, tasteless, owing to their sparing solubility. Antipyretic and analgesic. Dose three to ten grains (0.2–0.65 Gm.)
Acetylphenylhydrazin, $C_6H_5NH-NHCH_3CO$ (Pyrodin, Hydracetic)	Antipyretic. Powerful remedy. Dose, one-half to one grain (0.03 to 0.065 Gm.) per day
Acidum Diæthylbarbituricum, Veronal, $C_8H_{12}O_3N_2$	Prepared as a condensation product of diethylmalonic acid and urea by heating them together with sodium alcoholate for several hours at a temperature of 100°–108° C. (212°–226.4° F.). Used as an hypnotic; does not relieve pain. Dose five to fifteen grains (0.32–1.0 Gm.)
Aconium Dipara-anisyl-monophenetyl-guanidine Hydrochloride	A substitute for cocaine as a local anæsthetic. Commonly employed in solutions ranging in strength from 1–300 to 1–100
Adalin Bromine-di-ethyl-acetyl-carbamide $C(C_2H_5)_2Br$ $CONHCONH_2$	A white crystalline powder with a slightly bitter taste, almost insoluble in water. It is used as an hypnotic in milder forms of sleeplessness, it also possesses distinct analgesic properties and is useful in neuralgia, has been used as a nerve sedative. It does not produce the unpleasant after effects that the other hypnotics produce. Dose, five to fifteen grains (0.2–0.5 Gm.)
Agathin, $C_6H_4(OH)CH=N.N(CH_3)C_6H_5$ (Salicyl-alpha-methyl-phenyl-hydrazine)	A yellowish crystalline salt; insoluble in water, soluble in alcohol. Antiseptic and anti-neuralgic. Dose, eight to ten grains (0.5 to 0.6 Gm.)
Alpha-oxynaphthoic Acid, $C_{10}H_6\begin{cases}OH\\COOH\end{cases}$	Antizymotic, disinfectant. Used in the form of a 5 per cent. ointment
Alphol (Alphanaphthol Salicylate) $C_6H_4.OH.COOC_{10}H_7$	A reddish-white powder, soluble in alcohol and ether. It is used in doses of from eight to fifteen grains (0.5 to 1 Gm.) in rheumatism and as an intestinal antiseptic
Alphozone, Succinic dioxide	Prepared by the interaction of a strong solution of hydrogen peroxide and succinic anhydride. A fluffy white, crystalline powder, odorless. Used as a germicide and antiseptic in solutions of from 1–3000 to 1–1000
Alumnol (Betanaphthol-disulphonate of Aluminum), $(C_{10}H_5(OH)(SO_3)_2)_3Al_2$	A white powder, soluble in water and glycerin, slowly soluble in alcohol. It is used as an antiseptic and astringent; mixed with from 5 to 10 parts of starch in the form of a dusting powder and, in from 1 to 5 per cent solution, as a wash
Alypin, Benzoyl tetramethyl-diaminoethyl-propanol hydrochloride	The hydrochloride of a synthetic base derived from glycerin. A white crystalline powder soluble in water. Used as a local anæsthetic, externally in 10 per cent solution, hypodermatically in 1 to 4 per cent. solutions
Ammoniated Acetanilid	A mixture containing acetanilid 25 parts; sodium bicarbonate 5 parts; ammonium carbonate 10 parts and milk-sugar 60 parts. It has been recommended in place of acetanilid, being less depressing in action
Amygdophenin (Phenetidin Amygdalate) $C_6H_4.OC_2H_5NH.CO.CH.OH.C_6H_5$	Prepared by heating *p*-phenetidin with mandelic acid until all of the water is expelled, washing the product with diluted sodium hydroxide solution and crystallizing from ether-alcohol mixture. White crystalline powder or glistening scales. Used in rheumatic fever. Dose, ten to fifteen grains (0.65–0.97 Gm.) every 4 or 5 hours
Aniline, $C_6H_5.NH_2$	Prepared by treating an alcoholic solution of nitro-benzene with ammonia and hydrogen sulphide until a precipitation of sulphur takes place. The brown liquid is again saturated with hydrogen sulphide until sulphur ceases to be deposited. The liquid is then mixed with excess of acid, filtered, boiled, and then distilled with excess of caustic potash. A colorless, limpid, oily, inflammable liquid, of a peculiar wine-like odor and burning, aromatic taste. It is used chiefly in the preparation of aniline dyes
Anthrasol, Purified or Colorless Coal Tar	A thin, mobile, light-yellow, oily fluid, freed from pyridin and chinoline by acid treatment and from pitch by distillation; insoluble in water but miscible with oils and fats. Used as an antiseptic parasiticide in form of 5 to 30 per cent. ointment
Antithermin (Phenylhydrazin-levulinic Acid), $C(CH_3).C_6H_5N_2H.C_3H_5O_2$	In colorless crystals, insoluble in cold water. Used as an antipyretic, but with caution because of depressant action. Dose, three grains (0.2 Gm.)
Antitussin Di-fluor-di-phenyl $(C_6H_4F.)_2$	Used in whooping cough, by inunction in the form of a 5 per cent. ointment
Apolysin (Monophenetidin Citrate) $C_6H_4<\begin{matrix}OC_2H_5\\NH.CO.C_3H_4(OH)(COOH)_2\end{matrix}$	A yellowish-white, crystalline powder, sparingly soluble in water and glycerin. It resembles phenacetin chemically and medicinally, being used as an antipyretic and analgesic in doses of from eight to thirty grains (0.5 to 2 Gm.)

Unofficial Products obtained from Coal Tar, etc.—*Continued*

Asaprol (Beta-naphthol-alpha-mono-sulphonate of Calcium, Abrastol), $(C_{10}H_6.OH.SO_3)_2Ca+3H_2O$	A colorless, pale-reddish powder without odor, soluble in about 2 parts of water and 3 parts of alcohol. Used as an antipyretic and analgesic in acute muscular rheumatism in doses of five to fifteen grains (0.3 to 1 Gm.)
Benzacetin, Acet-amido-ethyl-salicylic Acid	Colorless crystals; soluble in alcohol and aqueous alkaline solutions. An analgesic. Dose, eight to fifteen grains (0.5 to 1 Gm.)
Benzamine Lactate Br. 1914 $C_{15}H_{21}NO_2.C_3H_6O_3$	A white crystalline powder used the same as alpha- and beta-eucaine, being more soluble than either of these salts
Benzanilid (Phenylbenzamide, Benzoylanilid) $C_6H_5NHCO_6H_5$	Obtained by the action of benzoyl chloride on aniline in the presence of sodium hydroxide. A pinkish powder, soluble in alcohol, insoluble in water. Used as an antipyretic for children in doses of one-half to five grains (0.03 to 0.32 Gm.)
Benzene (Benzol, Benzole) C_6H_6	Obtained by subjecting coal tar to fractional distillation. A thin, colorless, very inflammable liquid, having an aromatic odor. Nearly insoluble in water; soluble in alcohol, ether, etc. It is a valuable solvent. (See Reagents)
Benzonaphthol (Benzoylnaphthol, Benzoate of Naphthol, Betanaphthol Benzoate) $C_6H_5CO_2—C_{10}H_7$	Antiseptic. Dose, four to eight grains (0.25 to 0.5 Gm.), repeated frequently
Benzosol (Guaiacol, Benzoate, Benzoyl-guaiacol),  $C_6H_4O<\begin{matrix}O.CH_3\\O-C_6H_5.CO\end{matrix}$	White, crystalline powder, odorless and tasteless, soluble in alcohol, but insoluble in water. It contains about 54 per cent. of guaiacol and is used as an internal antiseptic in phthisis, in doses of from four to ten grains (0.25 to 0.65 Gm.)
Betol (Naphthalol, Naphthosalol, Salinaphthol, Betanaphthol Salicylate), $C_6H_4(OH)COO.C_{10}H_7$	White, odorless, tasteless powder, insoluble in water, but soluble in alcohol and ether. It is used as an internal antiseptic and antirheumatic in doses of from four to ten grains (0.25 to 0.65 Gm.)
Borophenol	Disinfectant. A combination of borax and phenol
Chinoline, C_9H_7N Quinoline	By mixing aniline, nitrobenzene, glycerin, and sulphuric acid, heating, then diluting with water and distilling to drive off nitrobenzene; on rendering the residue alkaline and distilling with steam, chinoline passes over. A colorless, mobile liquid, having a pungent, somewhat bitter-almond odor, and a bitter taste. Sp. gr. 1.081
Chlorazene (Para-toluene-sodium-sulphochloramide).	A white, crystalline salt, having a faintly chlorous odor and a bitter taste. Soluble in 8 parts of cold water. It is non-corrosive, does not percipitate or coagulate proteid, is less irritating than sodium hypochlorite solution and practically non-toxic. As a general surgical antiseptic a 1 per cent. solution may be used, but when infection is present, a 2 per cent. solution is more efficient. For eye, nose or throat infection a 0.1 per cent. solution is best adapted and a 0.7 per cent. jelly, prepared with sodium stearate or tragacanth, provides an efficient dressing for wounds. Gauze saturated with a 4 per cent. solution of chlorazene has also been used with much success
Chlorphenol, Monochlorphenol, $C_6H_4Cl.OH$	Germicide and antiseptic. Used by inhalation, and as a local application
Citrophen $C_3H_4(OH)(CONH.C_6H_4OC_2H_5)_3+3H_2O$	Prepared by heating a mixture of *p*-phenetidin and citric acid in the presence of a dehydrating agent, washing the product with a very dilute solution of sodium hydroxide and crystallizing from water. A white crystalline powder having an acidulous aromatic taste and acid reaction. Uses identical with acetphenetidin. Dose 5 to 10 grains. (0.32–0.65 Gm.)
Creolin	Said to be an emulsion of cresol obtained by means of rosin soap
Cresol Iodide (Losophan), $C_6HI_3(CH_3)OH$	A yellow powder, containing 80 per cent. of iodine. Soluble in alcohol, insoluble in water. Used as an external application in skin diseases, in the form of a solution or of an ointment
Cresol Salicylate, Cresalol	A crystalline powder resembling salol in action and uses. Dose, five to thirty grains (0.32–2 Gm.)
Cresol-Naphthol	A brown, viscous, tar-like liquid, having active germicidal properties
Cumene Trimethylbenzene $C_6H_3(CH_3)_3$	A colorless liquid used for sterilizing catgut, by keeping it immersed in the liquid for 2 hours at 160° C. (320° F.)
Cycloform, Isobutyl Para-Aminobenzoate $C_6H_4(NH_2)COO.CH_2.CH.(CH_3)$	A mild antiseptic and anæsthetic. Used in 5 to 20 per cent. ointments or suppositories. Internally in doses of one to three grains (0.065 to 0.2 Gm.)
Diacetanilid, $C_6H_5N(CH_3CO)_2$	Prepared by heating acetanilid with glacial acetic acid to 200°–250° C. (392°–482° F.) and extracting the mass with hot benzin from which the product crystallises in colorless leaflets. Its uses are similar to acetanilid but its action is more powerful

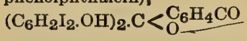
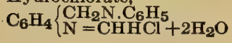
Unofficial Products obtained from Coal Tar, etc.—*Continued*

Dinitrocresol, $C_6H_3(NO_2)_2\begin{cases}CH_3\\OH\end{cases}$	"Saffron Substitute" is a mixture of the potassium salts of dinitro-, ortho-, and para-cresols. Used in 1–300 to 1–1000 solution, as an insecticide spray for plants
Dioxynaphthalene, $C_{10}H_8O_2$	Tonic. Dose, three grains (0.2 Gm.) a day
Di-phenyl-methyl-pyrazole	A substitute for antipyrine in the form of white needles, not very soluble in water or ether; easily soluble in alcohol and glacial acetic acid
Dipropylbarbituric Acid, Proponol, $C_{10}H_{16}O_3N_2$	Preparation analogous to that of Veronal. Uses similar to those of Veronal. Dose three to eight grains (0.2–0.5 Gm.)
Dithio-salicylic Acid, $\left.\begin{matrix}C_6H_3(OH)COOH.S\\C_6H_3(OH)COOH.S\end{matrix}\right>$	Antirheumatic. Dose, three grains (0.2 Gm.)
Eosin, $C_{20}H_8Br_4O_5$	A bronze-colored, crystalline powder, obtained from the action of phthalic acid upon phenols. Eosin is largely used as a dye, and for making a brilliant *red ink*, by dissolving 5 grains in a fluidounce of water in which 10 grains of acacia have been dissolved (see Reagents, Chapter LXII)
Epicarin, Beta-naphtholhydroxytoluic Acid	A parasiticide occurring on the market in pure and impure form, the latter being used in veterinary practice. The pure product is used in skin affections in 10 per cent. solution or in 10 to 20 per cent. ointment
Eudoxin (Tetra-iodo-phenolphthalein Bismuth)	A bismuth salt of nosophen containing about 52.9 per cent. of iodine and 14.5 per cent. of bismuth. Odorless, tasteless, insoluble powder, used as an intestinal antiseptic in doses of three to eight grains (0.2 to 0.5 Gm.)
Euphorin (Phenyl-urethane), $C_6H_5NH{-}CO{-}OC_2H_5$	Colorless, crystalline powder, soluble in alcohol and ether, slightly soluble in water. Used as an antipyretic, antirheumatic, and anodyne in doses of two to eight grains (0.13 to 0.5 Gm.)
Euphthalmine (Hydrochloride) (Phenylglycolyn-methyl-vinyl-Diacetonalkamine Hydrochloride)	A derivative of beta-eucaine, said to resemble atropine in its effect upon the system, producing prompt mydriasis without anesthetic action or pain. Use two to three drops of a 5 to 10 per cent. solution
Eupyrine, Vanillin-ethylcarbonate-para-phenetidin	Light-yellow needle-shaped crystals, tasteless and having a faint odor of vanillin. Used as a non-toxic antipyretic in doses of from fifteen to thirty grains (1.0–2.0 Gm.) once or twice daily
Euresol, Resorcin Monoacetate $C_6H_4(OH)OCOCH_3$	The action is similar to that of resorcinol but milder and more lasting. Used in from 5 to 20 per cent. ointments
Europhen (Di-isobutyl-ortho-cresol-iodide), $\left.\begin{matrix}C_6H_3(CH_3)(C_4H_9)O\\C_6H_3(CH_3)(C_4H_9)O\end{matrix}\right>HI$	A yellow, amorphous powder having an aromatic odor; soluble in alcohol, ether, and fixed oils, but insoluble in water. Used as antiseptic dusting powder or in 5 to 10 per cent. ointments. (Similar to thymol iodide)
Fluorescein, $C_{20}H_{12}O_5+H_2O$	Yellowish-red or dark red powder. Soluble in alcohol with yellow-red color and green fluorescence. Used to detect foreign bodies in the eye (see Regents, Chapter LXII)
Formadine	A reddish-yellow powder nearly odorless and tasteless, containing about 56.88 per cent. of iodine. As a dusting powder it is far superior to iodoform
Formanilid (Phenylformamide) $C_6H_5NH.HCO$	Prepared by heating analine with ethyl formate. Colorless prisms, soluble in water, glycerin, and fixed oils; readily soluble in alcohol. Antipyretic and analgesic in doses of from two to five grains (0.13 to 0.32 Gm.). Locally applied to mucous membrane it produces anæsthesia
Formylphenetidin $C_6H_4(OC_2H_5)NH.COH$	Colorless, odorless, tasteless crystalline scales. An antiseptic and analgesic. Dose, five grains (0.32 Gm.)
Fuchsin (Rosaniline), $C_{20}H_{19}N_3$	A non-volatile, colorless, bitter substance, produced whenever a mixture of aniline and toluidine is heated to about 180° C. (356° F.) with an oxidizing agent of moderate power, as, for example, arsenic trioxide. The solutions of some of its acid salts are used largely for dyeing silk and wool a magnificent crimson (see Reagents, Chapter LXII)
Gallacetophenone, $C_6H_2\begin{cases}(OH)_3\\CH_3CO\end{cases}$	Proposed as a substitute for pyrogallol as a local application
Gallanilid, Gallanol, $C_6H_5NH.CO.C_6H_2(OH)_3+2H_2O$	Prepared by heating gallic acid with an excess of analine at 150° C. (302° F.) the mixture treated several times with diluted hydrochloric acid and crystallizing from boiling water. Colorless, crystals, readily soluble in alcohol, ether and boiling water, sparingly soluble in cold water. Used in skin affections as a substitute for chrysarobin in 10 to 20 per cent. solution or ointment
Gallobromol, Dibromgallic Acid $C_6Br_2(OH)_3COOH$	A substitution compound of gallic acid. Used in place of potassium bromide as a sedative in cases of epilepsy in doses of ten to thirty grains (0.65–2.0 Gm.)
Geosote (Guaiacol Valerate)	The guaiacol ester of valeric acid; yellow, oily liquid of smoky odor and burning taste. Used as an antitubercular and intestinal disinfectant in three- to ten-minim (0.2 to 0.6 mil) doses

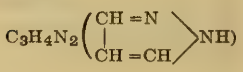
Unofficial Products obtained from Coal Tar, etc.—*Continued*

Guaethol (Ajacol, Thanatol, Pyrocatechin-mono-ethyl-ether), $C_6H_4{<}^{OC_2H_5}_{OH}$	An oleaginous fluid, congealing to a crystalline mass at low temperatures, soluble in alcohol and ether. Similar to guaiacol in medicinal properties. Dose two to four grains (0.13 to 0.25 Gm.)
Guaiacetin (Sodium Pyrocatechin Monoacetate) $C_6H_4.(OH).OCH_2COONa$	A white powder used in the treatment of tuberculosis and chronic bronchitis. Dose, eight grains (0.5 Gm.)
Guaiacol Carbonic Acid (Methoxy-salicylic Acid) $C_6H_4(OH)(OCH_3)COOH+2H_2O$	A white, odorless crystalline powder used in the treatment of tuberculosis and chronic bronchitis; used as an antiseptic and antirheumatic. Dose, eight grains (0.5 Gm.)
Guaiacol Cinnamate (Styracol) $C_6H_4(OCH_3)C_9H_7O_2$	Colorless, needle-shaped crystals used in catarrhal affections of the digestive tract and in the treatment of phthisis. Dose fifteen grains (1 Gm.)
Guaiacol Salicylate, Guaiacol Salol $C_6H_4(OCH_3)C_7H_5O_3$	This compound is analogous to salol. Used as an intestinal antiseptic. Dose, fifteen grains (1 Gm.)
Guaiasotol	The name of a preparation claimed to be syrup of guaiacol containing 2 grains of guaiacol to each fluidrachm. Dose, one to four teaspoonfuls (4 to 15 mils)
Halazone (Para-toluolsulphon-dichloramino-benzoic acid, Dakin-Dunham Tablets)	This tablet is used for the sterilization of water for drinking purposes. One-fourth of a milligramme (0.00025 Gm.) of Halazone will sterilize one quart of water in from fifteen to sixty minutes
Hetocresol, Metacresol Cinnamate $C_6H_5CH=CH.COOC_3H_4CH_3$	A white crystalline powder recommended for use in tuberculosis of the bladder in form of ½ per cent. suspension
Holocaine Hydrochloride (Ethenyl-paradiethoxy-diphenyl-amidine-Hydrochloride) $C_6H_4OC_2H_5NH.C(CH_3):N.C_6H_4.OC_2H_5.HCl$	A colorless, odorless, neutral crystalline powder, used as a substitute for cocaine in ophthalmic practice. Five minims of a 1 per cent. solution when introduced into the eye produces anæsthesia in from 1 to 10 minutes
Homosalicylic Acid, Cresotic Acid, $C_6H_3CH_3OHCOOH$	A fine crystalline powder, having a bitter but not repulsive taste. Never employed in the free state but always combined with sodium. Antipyretic, in doses of from thirty to sixty grains (2–4 Gm.)
Hydronaphthol	Silver white crystals used as a substitute for phenol because of its greater antiseptic power; it is non-toxic and non-corrosive. Said to be merely impure naphthol
Hydro-quinone, (Hydrochinone) $C_6H_4(OH)_2$ 1 : 4	Prepared by oxidizing aniline with chromium trioxide mixture. An antiseptic and antipyretic. Dose, five to ten grains (0.3 to 0.6 Gm.) Largely used as a developer in photography
Hypnone (Acetophenone), C_8H_8O or $C_6H_5.CO.CH_3$	A colorless liquid, having an almond-like odor, insoluble in water or glycerin, soluble in alcohol and ether. An hypnotic; dose ten to twenty minims (0.6 to 1.2 mils)
Ichthalbin (Ichthyol Albuminate)	A grayish-brown, odorless powder, insoluble in ordinary solvents, but soluble in alkaline solutions, as the intestinal secretions. Used as an intestinal antiseptic, and antiphlogistic in doses of ten to thirty grains (0.65 to 2 Gm.); also as an antiseptic dusting powder for wounds, etc.
Ichthargan, Silver Ichthyol	A compound containing about 30 per cent. of metallic silver. It is used as a bactericide, astringent and antiphlogistic in gonorrhœa
Ichthoform (Ichthyol-formaldehyde)	A blackish-brown, insoluble powder, with little odor or taste. Used as an antiseptic, in surgical practice, for dusting on wounds, etc., and as an intestinal antiseptic in doses of fifteen to thirty grains (1 to 2 Gm.)
Ichthyol (Ammonium ichthyol-sulphonate), $C_{28}H_{36}S_3O_6(NH_4)_2$	A tarry-looking substance, obtained from a brownish mineral, containing animal residues of fish, etc., found in Sufeld, in Tyrol. Purified by distillation and treatment with sulphuric acid. Ichthyol has an herb-like odor, and is faintly alkaline. Used for skin diseases. Dose, ten to fifteen grains (0.6 to 1 Gm.)
Ichthyol Sodium	Similar to Ichthyol but more firm in consistence
Iodantifebrin, (Iodacetanilid) $C_6H_4INH(C_2H_3O)$	In rhombic flakes. Melting at 181.5° C. (358.7° F.). Slightly soluble in cold water, readily soluble in alcohol
Iodophenacetin (Iodophenine)	Prepared by adding some moderately diluted hydrochloric acid and a solution of potassium iodide and iodine in water to a solution of phenacetin in glacial acetic acid, when, upon cooling, steel-blue crystals are deposited. Contains about 50 per cent. of iodine. Used externally
Iodopyrine, $C_{11}H_{11}IN_2O$	Prepared by mixing alcoholic solutions of iodine and antipyrine together and allowing to stand for several days, crystals separating out. Prismatic needles presenting the combined physiological action of iodine and an antipyretic. Used in bronchial asthma and tertiary syphilis. Dose ten to twenty grains (0.65–1.3 Gm.)
Lactophenin (Lactylparaphenetidin) $C_6H_4.OC_2H_5.N.H.CO.CH(OH).CH_3$	Prepared the same as acetphenetidin except that a lactic acid radical replaces the acetic acid radical. Uses similar to acetphenetidin and in the same dose
Liantrol	An extract of coal tar used in the treatment of eczema in 10 per cent. olive oil solution

Unofficial Products obtained from Coal Tar, etc.—*Continued*

Loretin (Meta-iodo-ortho-oxychinolin-ana-sulphonic acid), $C_9H_4IOH{-}SO_3H{-}N$	A yellow, odorless powder; almost insoluble in water; and insoluble in ether and oils. Used as a dusting powder to replace iodoform and in 5 to 10 per cent. ointments
Methacetin (Para-methoxyacetanilid) $C_6H_4(OCH_3).NHC_2H_3O$	Prepared like phenacetin except that methyl iodide or chloride is substituted for the respective ethyl compound. Lustrous, scaly, crystals; colorless, odorless. Antipyretic and analgesic in much smaller doses than phenacetin
Migrainin Antipyrine-caffeine Citrate	Prepared by fusing on a water bath a mixture of 85 parts of antipyrine, 9 parts of caffeine and 6 parts of citric acid. A colorless, hygroscopic powder used in the treatment of headache in doses of from five to fifteen grains (0.3–1 Gm.)
Methylacetanilid, Exalgine, $C_6H_5N(CH_3)CH_3CO$	Prepared by gradually adding acetyl chloride to monomethylanaline and crystallizing from boiling water, Colorless needles or prisms, inodorous and tasteless; freely soluble in alcohol, chloroform and boiling water. Employed as an analgesic. Dose three to ten grains (0.20–0.65 Gm.)
Naftalan	An ointment-like body prepared by distilling a peculiar naphtha from the Caucasus district of Asia Minor, mixed with an anhydrous soap. It is used with good results in cases of burns and in various skin diseases
Naphthalene, U. S. P. VIII $C_{10}H_8$	A distillation product from coal-tar, purified by distillation. Colorless, shining, transparent laminæ. Used as an insecticide
Neosalvarsan, $NH_2.OH.C_6H_3.As{:}As.C_6H_3.OH.NH(CH_2O)OSNa$	This substance is a soluble form of salvarsan (which see); its actions and uses are similar. It is a sodium 3-diamino- 4-dihydroxy- 1-arseno-benzene-methenol-sulphoxylate with inert inorganic salts. It may be administered by intravenous or intramuscular injection, preferably the former. For intravenous injection dissolve the neosalvarsan, freshly opened, under sterile conditions, in 25 mils of cold, sterile, freshly distilled water for each 0.15 Gm. of the salt, and the solution should be used immediately after its preparation to avoid decomposition and the development of actively poisonous compounds. The dose is the same as for salvarsan. The solution must not be warmed and the temperature throughout should be kept at about 20° C. (68° F.)
Neuronal, Bromodiethylacetamide $C_6H_{13}BrNO$	A white, crystalline powder used as an effective hypnotic. Dose, eight to fifteen grains (0.5–1.0 Gm.)
Nirvanin $(OH)C_6H_3(COOCH_3)NH.CO.CH_2.N{:}(C_2H_5)_2.HCl$	Colorless, prismatic crystals, having about one-tenth the toxicity of cocaine while said to be equally effective
Nitrobenzene, Nitrobenzol, Oil of mirbane $C_6H_5NO_2+H_2O$	A poisonous compound used in the perfuming of soap and in the manufacture of aniline
Nosophen (Iodophen, Tetra-iodo-phenolphthalein),  $(C_6H_2I_2.OH)_2.C{<}\begin{matrix}C_6H_4CO\\O\end{matrix}$	A yellow, odorless, tasteless powder, insoluble in water and alcohol. It contains about 60 per cent. of iodine, and is used as an antiseptic dusting powder and as an intestinal antiseptic, in doses of five to eight grains (0.32 to 0.5 Gm.)
Novaspirin, Methylenecitryl-Salicylic Acid $C_{21}H_{16}O_{11}$	White, used in from 1 to 10 per cent. solution in ophthalmology. Internally in doses of five to eight grains (0.32–0.5 Gm.), odorless powder of slight acidulous taste. Used as a substitute for other salicylates, in doses of twenty-four to thirty grains (1.5–2 Gm.)
Novocaine, (Para-aminobenzoyl Diethylamino-ethanol Monohydrochloride), $C_{13}H_{20}O_2N_2.HCl$	A local anæsthetic similar to cocaine in action but less toxic
Oleum Succini Oil of Amber	Amber is a fossil resin of an extinct coniferous wood, found principally upon the Baltic coast. By destructive distillation an acid liquor containing succinic acid is produced, together with crude oil of amber; the latter is redistilled, and rectified oil of amber is the product. It is a pale, yellow liquid, having an empyreumatic odor and a warm, acrid taste. Sp. gr. 0.920. It is soluble in alcohol, and when mixed with fuming nitric acid acquires a red color, and is subsequently converted into a brown resinous mass known as *artificial musk*
Orcin, Dihydroxytoluene, $C_6H_3(CH_3)(OH_2)$	Antiseptic, antipyretic. Poisonous (see Reagents, Chapter LXII)
Orexin, Phenyldihydrochinazolin Hydrochlorate,  $C_6H_4\left\{\begin{matrix}CH_2N.C_6H_5\\N=CHHCl\end{matrix}\right.+2H_2O$	Stomachic. Dose, four to seven grains (0.25 to 0.45 Gm.) two to three times a day

Unofficial Products obtained from Coal Tar, etc.—*Continued*

Orphol (Basic Betanaphthol Bismuth, Bismuth Naphtholate) $(C_{10}H_7O)_3Bi+3H_2O$	Fawn colored, almost odorless, and tasteless powder. It splits, in the intestines, into betanaphthol and bismuth. Used as an intestinal astringent and antiseptic in about five- to eight-grain (0.32 to 0.5 Gm.) doses.
Orthin, Orthohydrazinparaoxybenzoate, $C_6H_3.OH.COOH.NH.NH_2$	A feeble antipyretic
Orthoform (Methyl-para-amido-meta-oxybenzoate), $C_6H_3(OH)(NH_2)COOCH_3$	Methyl ester of meta-amido para-oxybenzoic acid. A white, odorless, tasteless powder, slightly soluble in water, soluble in alcohol or ether. It is used as an antiseptic and local anæsthetic in wounds, ulcers, burns, etc., and as an intestinal antiseptic in doses of eight to fifteen grains (0.5 to 1 Gm.)
Orthorform-New (meta-amino-para Oxybenzoate of Methyl) $C_6H_3.NH_2.OH.CO.O.(CH_3)$	A local anæsthetic resembling cocaine in action but not toxic. Used as a dusting powder, for insufflation, or as an ointment or oil solution
Oxychinaseptol (Diaphtherin), $C_6H_4(SO_2)\left\{\begin{matrix}O\text{–}NH.C_9H_6(OH)\\O\text{–}NH.C_9H_6(OH)\end{matrix}\right.$	A powerful antiseptic
Phenacetolin, Phenacetein, $C_{16}H_{12}O_2$	Used as an indicator in volumetric analysis to determine caustic alkali in the presence of alkali carbonates
Phenocoll Hydrochloride, (Amido-acetparaphenetidin Hydrochloride, Phenamin) $C_6H_4.OC_2H_5(NHCOCH_2NH_2).HCl$	Prepared by the action of chloracetylchloride on phenetidin and treating the product with ammonia; the basic substance is then neutralized with hydrochloric acid and the salt obtained in white crystalline powder. Used as an antineuralgic and antipyretic. Dose five to fifteen grains (0.32–1.0 Gm.); in large doses is valuable in rheumatic fever
Phenolsulphonephthalein, $C_6H_4.SO_2.C.(C_6H_4OH_2).O$	Used as an indicator and a diagnostic reagent
Phenolsulphonic Acid, (Sulpho-Carbolic Acid, Sulphophenic Acid), $C_6H_6SO_4$	This substance is produced by the direct action of concentrated sulphuric acid upon phenol. It is soluble in water and in alcohol. The acid is a decided antiseptic, and its solutions coagulate albumin
Phenosal (Phenetidin Acetosalicylate)	Colorless crystals having an acidulous taste. Used as an antipyretic and antineuralgic in articular rheumatism and sciatica. Dose five to fifteen grains (0.32–1.0 Gm.)
Phenosalyl	A mixture composed of 9 parts of phenol, 1 part salicylic acid, 2 parts lactic acid, $^1/_{10}$ part menthol. Used as an antiseptic in conjunctivitis and in eczema
Phenylhydrazine, $C_6H_5.NH.NH_2$	Poisonous. Used as a test for sugar in urine
Phenylsalicylic Acid $C_6H_5.C_6H_3.OH.COOH$	A white powder obtained by the dry distillation of a mixture of calcium benzoate and salicylate, the resulting product being fused with potassium hydroxide. Used as an antiseptic dusting powder
Phesin (Acetphenetidin-Sodium-Sulphonate)	A pale reddish-brown, bulky powder. It resembles phenacetin as an antipyretic and antineuralgic. Dose, eight to fifteen grains (0.5–1Gm.)
Phloroglucol, Phloroglucin $C_6H_3(OH)_3$	Use as an indicator (see Reagents Chapter LXII)
Phthalic Acid, $C_8H_6O_4$	Produced by heating salicylic acid with a mixture of sulphuric acid and potassium ferrocyanide, and, when the reaction is ended, treating the resulting mass with ether, which extracts the phthalic acid. It occurs in nacreous laminæ or shining monoclinic prisms. Soluble in alcohol, ether, and benzene
Pneumin, Methylene creosote	A yellow, odorless, tasteless powder. Used in tuberculosis and in pulmonary catarrh. Dose, eight grains (0.5 Gm.) 4 to 5 times daily
Proposote	A true chemical combination of creosote and phenylpropionic acid. Used as a substitute for creosote in pulmonary diseases also as an intestinal antiseptic. Dose, ten minims (0.6 mil) in capsules
Pyramidon, (Di-methyl-amido-phenyl-dimethyl-pyrazolon, Dimethylamido-antipyrine)	A yellowish-white, tasteless powder, similar to antipyrine in action, but milder, more gradual and lasting in its influence. Used as an antipyretic and analgesic in doses of three to ten grains (0.2 to 0.65 Gm.)
Pyrantin, Phenosuccin, $C_6H_4(OC_2H_5)N:(COCH_2\text{-}CH_2\text{-}CO)$	Prepared by melting together *p*-amidophenol and succinic acid and crystallizing the product from alcohol or acetic acid solution. Colorless, prismatic needles. Its uses are similar to acetphenetidin; valuble in acute rheumatism. Dose, fifteen to forty-five grains (1 to 3 Gm.) per day
Pyrazole,  $C_3H_4N_2\left(\begin{matrix}CH=N\\ \vert\\ CH=CH\end{matrix}\right\rangle NH)$	A diuretic. Dose, fifteen to thirty grains (1 to 2 Gm.) daily

Unofficial Products obtained from Coal Tar, etc.—*Continued*

Pyridine, C_5H_5N	Remedy for asthma. Five to twenty drops in two ounces of water may be used in an atomizer, or five drops may be inhaled directly. Dose, six drops, gradually increased to twenty-five, daily
Pyridine Nitrate, $C_5H_5N.HNO_3$	Colorless needles. Easily soluble in water, less so in alcohol
Pyridine Sulphate, $(C_5H_5N)_2.H_2SO_4$	Crystalline. Very soluble in water or in alcohol
Pyrosal, Antipyrine Salicylacetate $C_9H_8O_5C_{11}H_{12}N_2O$	Occurs in colorless leaflets or needles. Used as an analgesic, antipyretic and antirheumatic. Dose, five to ten grains (0.32–0.65 Gm.) several times daily
Rosolic Acid (Corallin)	Obtained by acting on commercial phenol with oxalic and sulphuric acids (see Reagents, Chapter LXII). Used as an indicator
Salacetol, Salantol, $C_6H_4(OH)CO_2CH_2COCH_3$	Fine white or slightly reddish crystalline needles, having a bitter taste. A germicide used in the treatment of dysentery and summer diarrhœa. It is less poisonous than salol. Dose, adult, twenty to forty grains (1.3–2.6 Gm.) and for children from five to eight grains daily (0.32–0.5 Gm.)
Salicylamide, $C_6H_4\left\{\begin{matrix}OH\\CONH_2\end{matrix}\right.$	Analgesic and antipyretic. Dose, three grains (0.2 Gm.)
Salicyl Bromanilid (Antinervine)	Antipyretic and analgesic. Dose, five to ten grains (0.32 to 0.65 Gm.)
Saliformin (Formin Salicylate Hexamethylenetetramine Salicylate, Urotropine Salicylate), $(CH_2)_6N_4.C_6H_4(OH)COOH$	A white powder, having a sour taste; soluble in alcohol and water. Used as a urinary antiseptic and as a solvent for uric acid deposits. Dose, fifteen to thirty grains (1 to 2 Gm.)
Salitannol, $C_{14}H_{10}O_7$	A condensation product of salicylic and gallic acids, formed by the action of phosphorous oxychloride; white amorphous powder. It is employed as a safe surgical antiseptic because of its non-poisonous properties
Salipyrine, Antipyrine Salicylate $C_{11}H_{12}ON_2.C_7H_6O_3$	Antipyretic, antirheumatic, antineuralgic. Dose, seven to fifteen grains (0.45 to 1 Gm.), in capsule or tablet
Salol-Camphor, Camphol	A local anæsthetic; a mixture of 3 parts of phenyl salicylate and 2 parts of camphor
Salophen, Acetylparamidophenyl-salicylate, $C_6H_4\left\{\begin{matrix}OH\\COOC_6H_4.NH(C_2H_3O)\end{matrix}\right.$	Antirheumatic and intestinal antiseptic. Dose, forty-five to seventy-five grains *during the day* (3 to 5 Gm.)
Saloquinine, Salochin	Prepared by heating a mixture of phenyl salicylate and anhydrous quinine in a vacuum. White, tasteless, odorless, crystalline, powder. Used in typhoid fever and neuralgia. Dose, eight to thirty grains (0.5–2.0 Gm.) daily
Salvarsan (Arsenphenol-amine Hydrochloride, Arseno-benzol, "606") $HCl.NH_2.OH.C_6H_3.As:As.C_6H_3.OH.NH_2.HCl+2H_2O$.	Salvarsan is the hydrochloride of 3-diamino-4-dihydroyl-1-arsenobenzene and represents 31.57 per cent. of arsenic. It is a specific for syphilis and is also used in affections due to spirillum, such as malaria and to replace other forms of arsenic. It is administered exclusively by injection, the intravenous method being preferred. It is prepared by triturating the weighed quantity of salvarsan, with sterile apparatus and under sterile conditions, with 0.7 mil of normal sodium hydroxide volumetric solution for each 0.1 Gm. of salvarsan used, and then, if necessary, adding, cautiously, enough more of the sodium hydroxide to just cause complete solution. This solution is then diluted with enough sterile physiological solution of sodium chloride to make from 100 to 250 mils (3 to 8 fluidounces), as may be desired, finally filtering through a sterile filter. The most exacting precautions must be taken to insure a sterile product, and the physiological salt solution should be freshly made from freshly distilled water (see page 309). The salvarsan, when the hermetically sealed container has been opened, or the solution, when prepared, must be used at once. When exposed to the air, even for a short time, decomposition results and the product becomes dangerously poisonous. The dose for children is from three to five grains (0.2–0.32 Gm.); for adults, five to nine grains (0.32–0.59 Gm.)
Sodium Arsenilate, Atoxyl $C_6H_4(NH_2)(AsO.OH.ON)+4H_2O$	Prepared by condensing aniline and arsenic acid, eliminating water, isolating the arsenilic acid and neutralizing with sodium carbonate. Used in treatment of syphilis, more toxic than salvarsan. Dose, three to eight grains (0.2–0.5 Gm.)
Solutol	A transparent, oily liquid miscible with water, used as a disinfectant
Sozolic Acid (Orthophenolsulphonic Acid), $C_6H_4(HSO_3)OH$	Antiseptic. A 33⅓ per cent. solution is called *aseptol*
Styptol, Cotarnine Phthalate $(C_{12}H_{13}O_3N)_2C_6H_4(COOH)_2$	Used internally as a special uterine vessel constrictor. Locally as a dusting powder. Dose, three-fourths of a grain (0.048 Gm.)

Unofficial Products obtained from Coal Tar, etc.—*Continued*

Subcutin, $C_2H_5COO.C_6H_4.NH_2.SO_3H.C_6H_4OH$	A white crystalline powder used as a local anæsthetic, non-toxic and distinctly germicidal
Sublamine, Mercury ethylenediamine sulphate, $HgSO_4.2C_2H_4(NH_2)_2+2H_2O$	A non-irritating, penetrating, readily soluble disinfectant. Used in hand disinfection in solutions of 1–1000 to 1–200
Succinic Acid, $C_4H_6O_4$	Used with advantage in delirium tremens
Succinyl, Disalicylic Acid Diaspirin, $C_{18}H_{14}O_8$	White, crystalline powder, almost tasteless and without odor. Forms salts with inorganic and organic bases. Uses similar to those of salicylic acid. Dose, fifteen grains (1 Gm.) 3 to 4 times daily
Sulphanilic Acid, 1 : 4 Para-amino-benzene-sulphonic acid	Produced by the action of strong sulphuric acid on colorless analine. Used in the dye industry and also in diazo test solution (see Reagents, Chapter LXII)
Tetrahydrobetanaphthylamine, $C_{10}H_7.H_4.NH_2$	A local mydriatic, used in from 1 to 5 per cent. solution
Thalline (Tetrahydroparaquinanisol), $C_9H_6H_4N(OCH_3)$	An antipyretic. The sulphate and tartrate are most used. The dose of either is from two to five grains (0.1 to 0.3 Gm.)
Thermodin, Phenacetin-Urethrane, $C_6H_4(OC_2H_5).N(COOC_2H_5)(CH_3CO)$	A compound of acetphenetidin and ethyl carbamate. Used as an analgesic, antipyretic and antiseptic, in typhoid fever, pneumonia, etc. Dose, five to ten grains (0.32 to 0.65 Gm.)
Thiocol (Potassium Guaiacol-Sulphonate)	A fine, white powder, soluble in water, and containing about 60 per cent. of guaiacol. Antitubercular and anticatarrhal. Dose, five to twenty grains (0.32 to 1.3 Gm.)
Thymacetin $C_6H_2.CH_3.C_3H_7(OC_2H_5).NH(C_2H_3O)$	Prepared from thymol in a manner similar to that of phenacetin from phenol. White crystalline powder. Used as an analgesic in doses of from three to fifteen grains (0.2–1 Gm.)
Tribromphenol, $C_6H_2Br_3.OH$ Bromol	Antiseptic
Trichlorphenol, $C_6H_2Cl_3OH$	Used in erysipelas, in the form of a glycerite containing 5 to 10 per cent., applied to the parts twice daily
Triphenin, (Propionyl-phenetidin) $C_6H_4.C_2H_5O.NH.(CH_3.CH_2.CO)$	Prepared by heating *p*-phenetidin with propionic acid. Colorless, odorless and slightly bitter crystals. Soluble in about 2000 parts of water. An antipyretic and analgesic. Similar in action to phenacetin. Dose, eight to fifteen grains (0.5–1 Gm.)
Tropæolin	Dye-color used as an indicator in volumetric analysis
Tumenol	Used as a local application in eczema, in a 10 per cent. solution
Tussol (Antipyrine Phenylglycolate, Antipyrine Mandelate), $C_{11}H_{12}ON_2.C_6H_5CH(OH)COOH$	This salt is said to be superior to antipyrine in the treatment of whooping cough. Dose, three-quarters to six grains (0.045 to 0.4 Gm.), according to age
Urasol, Afsol (Acetyl-methylene-disalicylic acid), $CH_2(C_6H_3.OC_2H_3O.COOH)_2$	Used in the treatment of muscular rheumatism and gout. Dose five to eight grains (0.32–0.5 Gm.)
Valeridin, Valerydin, Sedatin (Iso-Valeryl-*p*-phenetidin) $C_6H_4.NHCOC_4H_9.OC_2H_5$	Prepared by heating *p*-phenetidin with valeric acid. White glistening needles almost insoluble in water but soluble in alcohol. Used in migraine, neuralgia and hysteria in dose of eight to fifteen grains (0.5–1 Gm.)
Xeroform (Tribromphenol Bismuth, Tribromocarbolate of Bismuth), $(C_6H_2Br_3O)_2BiOH+Bi_2O_3$	A yellowish-green, insoluble powder, containing about 50 per cent. of tribromphenol and about 50 per cent. of Bi_2O_3. Used as an intestinal antiseptic in doses of eight to fifteen grains (0.5 to 1 Gm.). Also used as a dusting powder on fresh and infected wounds
Xylol (Xylene), C_8H_{10}	By treating the oily liquid separating from diluted crude wood spirit and from the light oil of wood tar or coal tar, first with sulphuric acid, and afterwards subjecting these liquids to fractional distillation, collecting only that portion which distils between 136° and 140° C. (276.8° and 284° F.). A thin, colorless liquid, resembling benzene. It has a burning taste. Soluble in alcohol. Dose, twenty to thirty minims (1.2 to 2 mils)

QUESTIONS ON THE CELLULOSE GROUP

What is cellulose? (See page 980.) What is its formula in symbols? What is lignin?
What are some other special forms of cellulose?
Give an example of pure cellulose. Describe it, and give specific gravity.
In what solution is it soluble, and to what purpose is this fact applied?
How is artificial silk prepared?
When cellulose is treated with strong sulphuric acid, what change takes place?
If the mixture be diluted with water and heated, what will be produced?
How is parchment paper made, and for what is it used?
When cellulose is treated with nitric acid, what is produced?
Purified cotton—What is the Latin official name? By what name is it commonly known? What kind of cotton is meant?
How is it obtained? For what purposes in pharmacy is purified cotton used?
Describe appearance, odor, taste and solubility.
What impurities are likely to be present and how may they be detected?
Styptic cotton—What is the Latin title? How is it prepared and used?
Pyroxylin—What is the Latin official name? What is the synonym? How is it made?
What compounds are made by the action of nitric acid on cellulose?
Explain the reactions which take place in their formation.
Give the official characteristics and description.
Give solubility and test for impurity.
What are the uses of pyroxylin?
What is celluloid? For what purposes is it used?
Oxalic acid—Give its formula in symbols.
How may it be made?
In combination with bases, what salts does it form?
What are the most important of these salts?
What is "salt of sorrel" or "essential salt of lemons"?
How do these act in removing iron rust from linen?
For what is oxalic acid used?
In case of poisoning by oxalic acid, what is the best antidote?
What is the result when wood is distilled in close vessels?
From dry woods about what per cent. of charcoal is obtained, and about what per cent. of liquid products?
Name some of the principal solid, liquid, and gaseous products.
Of these products, which are the most important?
Acetic acid—What is the official Latin name?
How much absolute acetic acid does it contain? Give its formula in symbols.
What is pyroligneous acid?
How is the best acid for medicinal purposes obtained?
How is acetic acid made in Germany? Explain the chemical reactions? What is the intermediate product? Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for its identity.
How may the following impurities be detected?—viz: Fixed impurities; heavy metals; sulphuric acid; hydrochloric acid; formic or sulphurous acids; empyreumatic substances.
What strengths of acetic acid are found in commerce?
Why is one of them called No. 8?
What is the strength and specific gravity of "No. 8" acid?
What are the salts of acetic acid called? How may they be recognized?
Diluted acetic acid—What is the Latin name? Give description and specific gravity. How is it made, and for what is it used?
How much absolute acetic acid does it contain?
Why is it superior to vinegar as a menstruum?
Glacial acetic acid—What is the Latin official name? Give its formula in symbols.
How is it made? Describe its appearance, odor, and taste. What is its specific gravity? How may its strength be tested?
Can its specific gravity be relied on as a criterion of its strength? Why?
How may the glacial acid be distinguished from the weaker acid having the same specific gravity?
For what substances is glacial acetic acid a solvent? What are its uses?

Trichloracetic acid—What is the Latin title and the chemical formula in symbols? How may it be made?
Describe appearance, odor, chemical reaction, and solubility. What are the tests for identity? What impurities are likely to be present and how may they be detected?
For what is it used medicinally?
Acetone—What is the Latin title and the chemical formula in symbols?
By what chemical name is it known?
How may it be made? Describe its appearance, odor, taste, chemical reaction, and solubility. What is the specific gravity?
Give tests for identity. How may the impurity of fixed residue or empyreumatic substances be detected?
For what is it used in pharmacy and the arts?
Tar—What is the Latin official name and synonym? What is it, and how is it obtained?
Describe its physical properties. What are its uses?
What are its solubilities?
What official preparations are there of tar?
Alkaline solution of tar—What is the Latin title? How is it prepared? What are its uses?
Rectified oil of tar—What is the Latin official name? Give the synonyms. How is it obtained? Give description, specific gravity and solubility.
What is black pitch?
Why is the oil generally preferred to tar for medicinal uses? What are its uses and the dose?
Oil of cade—What is its Latin official name? What are the common names or synonyms? How is it obtained? Give description and specific gravity. What impurities are likely to be present and how may they be detected? What are its uses?
What is creosote, and of what phenols does it consist?
How is it obtained? Describe odor, taste, chemical reaction, and solubility.
How may it be distinguished from phenol? What are its uses?
In case of poisoning by it, what would be the proper treatment?
For what is creosote used medicinally and what is the dose?
What official preparations are there of creosote?
Creosote carbonate—Of what does this consist? How is it prepared?
Describe its appearance, odor, taste, reaction and solubility. What is its specific gravity? Give the tests for identity and purity. What are its medicinal uses? What synonym is used for it?
Guaiacol—What is this substance? How does this differ from creosote? How is it obtained?
Describe appearance, odor, taste, reaction, and solubility.
Give specific gravity and tests for identity.
What tests may be applied to indicate the absence of impurities?
For what is it used and what is the dose?
Guaiacol carbonate—Give the Latin title and chemical formula in symbols.
How is it made?
Describe appearance, odor, taste, chemical reaction and solubility. What are the tests for identity and the presence of free guaiacol and readily carbonizable impurities?
What is a common name for it? What is its use and dose?
What is coal? Explain the differences in its structure and composition.
What is coal tar?
When coal tar is subjected to distillation and rectification, what products does it yield? 1. Solids; 2. Liquids; 3. Gases.
Describe the appearance, odor, taste and reaction of coal tar. What are its solubilities? Give tests for identity and purity. How is it used medicinally?
Coal tar solution—How is it prepared? What is the Latin title and the synonym? What are its uses?
Betanaphthol—What is its Latin official name? Give the synonym.
How is it obtained? Give description, tests, dose, and uses.
Cresol—Give the chemical formula in symbols. How is it obtained? By what other names is it known? What varieties of cresol constitute the official substance? How does it differ from phenol?

Describe appearance, odor, reaction, and solubility. What is its specific gravity and boiling point?
How may the impurity of hydrocarbons be detected?
For what is it used and in what form?
Compound solution of cresol—What is the Latin title? How is it made? This compound is similar to what well-known solutions?
What modifications are permissible in its manufacture? Give their advantages. What are its medicinal uses?
Phenol—Give formula in symbols and synonym.
What is phenol and how obtained? How much absolute phenol is present? Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurities be detected?—What is the official assay for the quantity of phenol present?
For what purpose is it used? What antidote should be used in case of poisoning by phenol? What is meant by the phenol coefficient? What is the dose? What are the official preparations?
Liquefied phenol—What is the Latin official title? Give the synonym. How much absolute phenol does it contain? How is the phenol liquefied?
Describe appearace, odor, and miscibility. What is the specific gravity?
What are its advantages and uses? What is the dose?
What official preparations are made from it?
Iodized phenol—What is the Latin title and synonym?
How is it prepared? How is it used?
Phenolphthalein—What is this substance chemically? How may it be prepared?
Describe appearance, odor, taste, and solubility.
Give tests for identity. What impurities are likely to be present and how may they be detected? What are its chemical and medicinal uses?
Trinitrophenol—What is its chemical formula and synonym? What cautions are necessary in transporting it and why?
Describe its appearance, odor, taste, reaction and solubilities.
Give tests for identity and purity. What are its uses and dose?
Thymol—Give the chemical formula. To what class of chemicals does this substance belong? How is it obtained and from what source?
Describe appearance, odor, taste, and solubility. What are the tests for identity? What is the value medicinally? In what official preparation does it enter? If triturated with certain substances what results? Name some of them. Give the dose.
Thymol iodide—Give Latin title and chemical formula in symbols.
What per cent. of iodine should it contain?
How may it be prepared?
Describe appearance, odor, solubility and tests for identity.
How may the following impurities be detected?—Halogen salts; moisture; alkalies; free iodine; ash.
By what name is it commonly known?
For what is it used in medicine?
Resorcinol—What is the Latin official title? What is the synonym?
What other names are given to it? How may it be prepared?
Describe its appearance, tests, and solubilities. What are its medicinal properties? Give the dose.
Salicylic acid—Give Latin name and formula in symbols. From what sources may it be obtained?
Describe Kolbe's process for making it.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Iron; phenol; coloring matter; organic impurities; hydrochloric acid. In what N. F. preparations is it used?
What is the dose? What salts of this acid are official?
Phenol salicylate—What is its Latin official name? What is the synonym? How is it obtained?
Describe its appearance, tests, and solubilities.
How may the following impurities be detected?—Ash; free acids; uncombined phenol or salicylic acid; sulphate; chloride.
What are its medicinal and pharmaceutical uses? Give the dose.
Acetphenetidin—Give the Latin title, chemical formula, name, and synonym. How is it obtained?

Describe appearance, odor, taste, reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—Ash; readily carbonizable impurities; acetanilid; para-phenetidin.

For what is it used? Give the dose.

Methylthionine chloride—Give the Latin title; also chemical formula and synonym. How is it obtained?

Describe appearance and solubility. Give tests for identity.

How may the following impurities be detected?—Ash; arsenic; zinc; dextrin.

For what is it used? What is the dose?

Acetanilid—What is its Latin title? By what other name is it known? How is it made?

Describe its appearance, odor, taste, chemical reaction, and solubility.

Give the tests for identity. What impurities are likely to be present, and how may they be detected?

For what is it used medicinally and what is the dose?

What preparation of acetanilid is official in the N. F.?

Antipyrine—What is the Latin title, the chemical formula in symbols, the synonym, and the chemical name?

How is it made by Knorr's process?

Describe its appearance, odor, taste, chemical reaction, and solubility. How may the presence of impurities be detected?

For what is it used medicinally and what is the dose?

Benzosulphinide—What is this substance? Give the synonyms. How is it prepared? Describe its appearance, odor, taste, and solubility.

Give tests for identity and purity. In what official preparations is it used?

What are its uses and dose? May it be used in foods or beverages?

CHAPTER L

AMYLACEOUS AND MUCILAGINOUS PRINCIPLES AND THEIR PRODUCTS

Starch has the same chemical composition as cellulose, $C_6H_{10}O_5$, and is closely allied to it in its properties. Starch is stored up in plants in anticipation of future usefulness in the formation of their cell-walls, growing tissues, or other constituents. It exists in the form of granules, the shape of which may be described as spherical, ellipsoidal, ovoid, lenticular, polygonal, or irregular, and it is possible to identify the varieties of starch obtained from various plants, with the aid of the microscope, by the shape and size of the granules.

The granules consist of layers of different densities, arranged concentrically around a central point termed the hilum, which is usually at one end of the granule. Corn starch is official in Part I of the U. S. P. and potato starch in Part II, as a reagent in the assay of diastase and malt.

AMYLUM. U. S. **Starch**

[**Amyl.**—Corn Starch]

The starch separated from the grain of *Zea Mays* Linné (Fam. *Gramineæ*).

Preparation.—Starch is made from potatoes by first grating them, and then pressing the soft mass upon a sieve, which separates the cellular substances and permits the starch granules to fall through. These must be thoroughly washed, the quality of starch depending largely upon the purity of the water that is used in washing it. In making starch from wheat or corn, the gluten must be separated. This is generally done by permitting it to become sour and disintegrated through acetous fermentation, stopping the fermentation before the starch is affected. Upon the small scale, starch may be made from wheat flour by placing it in a fine linen bag and kneading it while a small stream of water trickles upon it. The starch is carried off with the water, while the *gluten* remains as a soft mass in the bag; the latter may be purified and used in making *gluten suppositories*. The quality of commercial starch largely depends upon the purity of the water used in its manufacture.

Official Description.—In fine powder, or irregular, angular, white masses; consisting chiefly of polygonal, rounded or spheroidal starch grains from 0.003 to 0.035 mm. in diameter, usually with a lenticular or 3- to 4-rayed central cleft, or in the rounded grains, with a circular marking.

Odor, Taste, and Reaction.—Inodorous; taste slight, characteristic. Triturate about 0.5 Gm. of Starch with 5 mils of distilled water; the mixture is neutral to litmus.

The individual starch grains are colored a deep blue by iodine T.S.; upon boiling 1 Gm. of Starch with 15 mils of water and cooling, it yields a translucent, whitish jelly.

Solubility.—Corn starch is insoluble in cold water and in alcohol.

Tests for Identity and Purity.—Incinerate about 0.5 Gm. of Starch; not more than 0.5 per cent. of ash remains.

U. S. P. Preparation.—It is used as a diluent in powdered extracts.

N. F. Preparations.—Glyceritum Amyli; Stilus Acidi Salicylici Dilubiles; Pasta Resorcinolis Fortis; Pasta Resorcinolis Mitis; Pasta Zinci.

Starch is present in many drugs, and is an important constituent of many vegetable foods.

Starch, by the action of diluted acids, diastase, or heat, is converted into *dextrin*, a substance resembling gum in appearance and properties. Dextrin is largely dissolved by water, hot or cold, and forms a mucilaginous solution, from which it is precipitated by alcohol. Large quantities of dextrin are now made both in America and abroad, and employed for various purposes in the arts, under the name of *artificial gum* or *British gum.* It is found in the market in the form of a white, brilliant powder, or in small masses or fragments resembling natural gum. It may be distinguished from gum arabic by the taste and smell of potato oil which it always possesses. It is now official in the N. F. (see page 1032).

Inulin, $C_{12}H_{20}O_{10}$, is a substance closely allied to starch. It is found particularly in the plants belonging to the family Compositæ, as Inula, Taraxacum, Pyrethrum, Lappa, etc. It has also been found, according to Kraus, in plants of the Campanulaceæ, Goodeniaceæ, Lobeliaceæ, and Stylidaceæ. It differs from starch in the following particulars: it is colored yellow by iodine, does not gelatinize with water, and is not found in plants in the form of granules having concentric layers like starch.

Uses.—Starch is used in a number of official preparations but chiefly because of its filling or absorbent properties. It is used externally as an absorbent, and is applied to the skin by dusting.

Unofficial Amylaceous Substances and Derivatives

Acorn	From the genus *Quercus.* Acorns contain besides starch a peculiar saccharine substance, *quercite*
Bean	From *Faba vulgaris* and *Phaseolus vulgaris*
Barley	*Hordeum distichon.* Contains 60 to 68 per cent. of starch, glutin, gum, and sugar
Canna	From the rhizome of *Canna edulis.* Fam. Marantaceæ, Cannæ. Indigenous to Peru and Brazil. The starch granules are very large, and exhibit a glistening or satiny appearance. It forms a cloudy but very tenacious jelly with boiling water
Cassava Tapioca Manioc	From the root of *Manihot utilissima.* Fam. Euphorbiaceæ. Habitat, Tropical America. The starch granules are about half the size of the potato starch granules, in somewhat translucent pieces, inodorous, having an insipid taste
Curcuma Turmeric	From the rhizome of *Curcuma longa.* Fam. Zingiberaceæ. Habitat, Southern Asia, cult. The starch granules are rather larger than those of maranta
Maranta Arrowroot	From the rhizome of *Maranta arundinacea.* Fam. Marantaceæ. Indigenous to West Indies and tropical America. Prepared by removing the scales from the rhizome, mashing and grinding in a mill until reduced to a pulp, then suspending this in water, and separating the fibrous portion, either by hand or sieve; lastly, washing thoroughly, and drying with a gentle heat. The yield is from 13 to 20 per cent. of fecula. It forms an opaque jelly with concentrated hydrochloric acid
Oats	From *Avena sativa.* Fam. Gramineæ. Habitat, Asia, cult. The grain contains 64 to 66 per cent. of starch, besides protein compounds, fat, salts, etc.
Pea	From *Pisum sativum.* It yields about 37 per cent. of starch
Potato	(See U. S. P. Reagents, Chapter LXII)
Sweet Potato	From *Convolvulus Batatus.* The yield of starch is about 16 per cent.
Rice	From *Oryza sativa.* Prepared by heating rice with weak soda-lye, which dissolves the nitrogenous impurities and leaves pure starch, then adding a solution of borax to facilitate the separation of the starch from the gluten. The yield is about 88 per cent.
Rye	From *Secale cereale.* The yield of starch is about 64 per cent.
Sago	From the pith of *Metroxylon Sagu.* Fam. Palmæ. Prepared by powdering the pith of the tree, washing with water to remove woody tissue and other impurities; lastly, drying carefully and granulating
Wheat	From *Triticum vulgare.* Fam. Gramineæ. Formerly official, now replaced by corn starch

MALTUM. U. S. Malt

The grain of one or more varieties of *Hordeum sativum* Jessen (Fam. *Gramineæ*), partially germinated artificially, and then dried at a temperature not exceeding 55° C. (131° F.) It is capable of converting not less than 5 times its weight of starch into sugars. Protect it from heat and moisture.

Official Description.—It occurs in yellowish or amber-colored grains; crisp when fractured, the interior surface nearly white. Malt floats in cold water.

Odor and Taste.—It has an agreeable, characteristic odor, and a sweet taste due to the conversion of the starch in the seed into maltose, through the action of diastase.

Tests for Identity and Purity.—For the subsequent tests, prepare an infusion as follows: Mix 10 Gm. of Malt in No. 12 powder, with 100 mils of distilled water and maintain the mixture at a temperature of from 50° to 55° C. (122°–131° F.) for one hour with occasional stirring. Place it upon a filter and when the liquid has passed through, wash the contents of the filter with distilled water, in small portions, until the combined infusion and washings measure 200 mils.

The weight of the solid soluble constituents of Malt, obtained by evaporating to dryness on a water bath an aliquot portion of the freshly prepared, aqueous infusion, and subsequently drying it for one hour at 100° C. (212° F.) in an air bath, corresponds to not less than 70 per cent. of the Malt taken.

The acidity of Malt (calculated as lactic acid) does not exceed 0.3 per cent. as determined by titrating an aliquot portion of the freshly prepared infusion with tenth-normal potassium hydroxide V.S., phenolphthalein T.S. being used as indicator. Each mil of tenth-normal potassium hydroxide V.S. used corresponds to 0.009 Gm. of Lactic acid.

Assay.—To determine the starch converting power of Malt, proceed as directed under *Diastasum*, page 1024, using 20 mils of the infusion of malt, prepared as directed above, in place of the quantity of solution of diastase there directed.

U. S. P. Preparation.—Extractum Malti.

Preparation.—When barley is steeped for two or three days in water, it swells, becomes somewhat tender, and the water is colored reddish-brown. If the water is drained off, and the barley is spread about two feet thick upon a floor (a stone floor is generally used), it heats spontaneously, and germination begins, the radicle making its appearance first. The growth of the grain is partially stopped at this stage by spreading it more thinly, and turning it over for two days. It is then raked into heaps and allowed to stand a day, when it becomes hot, and is subsequently thoroughly dried in a kiln by a slow, regulated heat. This is malt, and it differs in quality according as it is more or less soaked, drained, germinated, dried, or baked. It is distinguished by its color, being pale, amber, brown, or black malt, according to the degrees of heat used in drying it. The object of converting grain into malt is to change the *starch*, naturally present in the grain, into *maltose*, a peculiar kind of sugar, and dextrin. This is effected through the presence of *diastase*, a peculiar and powerful ferment, which is developed during the partial germination to which the grain is subjected in malting, this substance now being official (see page 1024). A portion of the starch is always left unchanged by the process of germination, its conversion into maltose being completed during the heating in the kiln. The diastase which is developed is capable of converting into maltose much more starch than is contained in the grain in which it is produced; hence, if good malt is added to a certain quantity of unmalted grain, the starch in the latter may be also converted into maltose. Malt seldom contains diastase in larger proportion than two parts in a thousand. Diastase is obtained by bruising malt, adding about half its weight of water, expressing strongly, treating the viscid liquid thus obtained with sufficient alcohol to destroy its viscidity, then separating the coagulated albumen, and adding a fresh portion of alcohol, which precipitates the diastase in an impure state. To render it pure, it must be redissolved as often as three times in water, and precipitated by alcohol. Diastase is solid, white, tasteless, soluble in water and in weak alcohol, but insoluble in the latter fluid when concentrated. Though without action upon gum and sugar, it has the extraordinary property, when mixed, in the proportion of only one part to two thousand, with starch suspended in water, and maintained at a temperature of about 71.1° C. (160° F.), of converting that principle into dextrin and *maltose.* Although malt has been manufactured in large quantities for centuries for brewing purposes, it is now also employed in medicine, in the form of extracts of malt, malt foods, etc. Its usefulness in this connection is due to the fact that the amount of diastase present in good malt has the power of *rendering starchy substances which are taken into the stomach as food soluble*; and good preparations of malt are not only easily digested food products themselves, but also actively aid in the digestion of other substances. Some of the commercial malt extracts consist of glucose colored with caramel and slightly flavored with extract of malt.

DIASTASUM. U. S. **Diastase**

A mixture containing amylolytic enzymes obtained from an infusion of malt. It converts not less than 50 times its weight of potato starch into sugars. Preserve it in well-closed containers, protected from light, heat and moisture.

Preparation.—It is prepared by adding alcohol to an infusion of malt at a temperature not exceeding 60° C. (140° F.), collecting and purifying the precipitate.

Official Description.—It occurs as a yellowish-white amorphous powder or in translucent scales. It converts starch into dextrin and maltose.

Odor and Taste.—Odorless and tasteless.

Diastase gradually loses its amylolytic power on keeping; this power is destroyed by heating its solutions above 85° C. (185° F.) or by the addition of much acid and is diminished by the presence of acids or alkalies.

Solubility.—Diastase is soluble in water, the solutions being more or less turbid; almost insoluble in alcohol.

Assay.—Mix a quantity of potato starch, purified as directed under *Pancreatinum,* equivalent to 5 Gm. of dry starch, in a beaker with 10 mils of cold distilled water. Add 140 mils of boiling distilled water, and heat the mixture on a water bath with constant stirring for two minutes, or until a translucent, uniform paste is obtained. Cool the paste to 40° C. (104° F.) in a water bath previously adjusted to this temperature. Prepare a fresh solution of 0.1 Gm. of Diastase in 10 mils of distilled water at 40° C. (104° F.) and add it to the paste. Mix them well and maintain the same temperature for exactly thirty minutes, stirring frequently; a thin, nearly clear liquid is produced. Add at once 0.1 mil of this liquid to a previously made mixture of 0.2 mil of tenth-normal iodine V.S. and 60 mils of distilled water; no blue or reddish color is produced.

Uses.—It is used as a digestant for starchy foods in doses of one to eight grains (0.065–0.5 Gm.). As it is not active in acid media, it should be given about a half hour after beginning a meal while the stomach is yet alkaline.

CHONDRUS. U. S. Chondrus

[IRISH MOSS CARRAGEEN]

The dried plant of *Chondrus crispus* (Linné) Stackhouse or of *Gigartina mamillosa* (Goodenough et Woodward) J. Agardh (Fam. *Gigartinaceæ*).

Official Description.—Entire plants more or less matted together, consisting of a slender stalk from which arises a series of dichotomously branching, more or less flattened segments, emarginate or deeply cleft at the tips; from 5 to 15 cm. in length, and 1 to 10 mm. in width; yellowish-white, translucent, frequently coated with a calcareous deposit which effervesces with hydrochloric acid; sometimes with fruit bodies or sporangia embedded near the apex of the segments (in *C. crispus*) or with sporangia borne on short tuberculated projections or stalks, more or less scattered over the upper portion of the segments (in *G. mamillosa*); somewhat cartilaginous: odor slight, seaweed like; taste mucilaginous, saline.

Tests for Impurities.—*Gelatin.*—Boil one part of Chondrus for about ten minutes with 30 parts of water, replacing the water lost by evaporation; the strained liquid forms a thick jelly upon cooling. When softened in cold water Chondrus becomes gelatinous and transparent, the thallus remaining nearly smooth and uniform and not swollen except slightly at the tips; a solution made by boiling 0.3 Gm. of the drug in 100 mils of water and filtering gives no precipitate on the addition of tannic acid T.S.

Starch.—And when cold does not give a blue color on the addition of iodine T.S.

N. F. Preparations.—Gelatinum Chondri; Mucilago Chondri.

This alga grows in the Atlantic Ocean. It contains 70 per cent. of a mucilaginous principle, which has been termed *carrageenin.* This differs from *gum* by not precipitating with alcohol, from *starch* by not becoming blue upon the addition of iodine, and from *pectin* by not being precipitated by lead subacetate.

Uses.—Chondrus is used principally as an emulsifying agent for cod liver oil, the mucilage being used, and to form a "sick diet" jelly, one part being sufficient to form a jelly with sixty parts of water. It should be previously soaked in a small quantity of water, to dissolve adherent salts, and this water thrown away.

GELATINUM CHONDRI. N. F. Chondrus Gelatin

[**Gelat. Chondr.**—IRISH MOSS GELATIN]

	Metric	Old form
Chondrus	**100 Gm.**	4 oz. av.
Water, a sufficient quantity.		

Wash the chondrus, with cold water, then place it in a suitable vessel, add 5000 mils [old form about 12 pints] of hot water, and heat it on a water bath for fifteen minutes, frequently stirring. Strain the decoction, while hot, through a strong muslin strainer; return the strained, mucilaginous liquid to the water bath, evaporate it to a semi-fluid consistence, then transfer it to shallow, flat-bottomed trays, and evaporate it at a temperature not exceeding 90° C. (194° F.) so that the product may be detached in scales.

Uses.—It is used as a demulcent and nutritive.

AGAR. U. S. Agar

[Agar-agar]

The dried mucilaginous substance extracted from *Gracilaria* (*Sphærococcus*) *lichenoides* Greville and other marine algæ growing along the eastern coast of Asia, particularly several species of *Gelidium*, or *Gloiopeltis* (Class *Rhodophyceæ*).

Official Description.—Mostly in bundles from 4 to 6 dm. in length, consisting of thin, translucent, membranous, agglutinated pieces from 4 to 8 mm. in width; externally yellowish-white or brownish-white; tough when damp, brittle when dry.

Odor and Taste.—Odor slight; taste mucilaginous.

A fragment mounted in water and examined under the microscope gradually becomes more transparent, showing a granular structure and a few diatoms, notably the frustules of *Arachnoidiscus Ehrenbergii* Baillon, which are disk-shaped and from 0.1 to 0.2 mm. in diameter, and also fragments of the spiculæ of sponges; upon the addition of iodine some of the granules or hyphal portions are colored bluish-black.

Tests for Identity and Purity.—*Gelatin.*—Insoluble in cold water, but slowly soluble in hot water. A solution made by boiling 0.1 Gm. of Agar in 100 mils of water, upon cooling yields no precipitate upon the addition of tannic acid T.S.

Starch.—And does not produce a blue color upon the addition of iodine T.S.

Boil 1 part of Agar for about ten minutes with 100 parts of water, and replace the water lost by evaporation; it yields a stiff jelly upon cooling.

The powder is pale buff; when mounted in water and examined under the microscope it shows transparent, more or less granular, striated angular fragments, occasionally containing frustules of diatoms; with iodine T.S., fragments for the most part are colored bright red, certain more or less definite areas being stained bluish-black.

Agar yields not more than 5 per cent. of ash.

Uses.—It is used as a culture media for bacteriological work (see Diagnostical Reagents, Chapter LXII), also administered internally, in doses of two to three drachms (7.7–11.6 Gm.), to give moisture and bulk to the intestinal contents in chronic constipation.

PERSIO. N. F. Cudbear

A purplish-red powder prepared from species of *Roccella* De Candolle, *Lecanora* Acharius, or other lichens.

Preparation.—This coloring agent is prepared by boiling the lichens with water containing chalk in suspension and then concentrating the liquid in a vacuum to a specific gravity of about 1.06. The lichen residue is then dried, transferred to a large vat, mixed with twice its weight of the concentrated liquid and one-sixth its weight of ammonia water, and kept at a temperature between 25° and 30° C. (77° and 86° F.) for two or three months with occasional stirring. Finally the mass is dried and powdered.

Official Description.—An aqueous or alcoholic preparation of Cudbear is of a deep red color which is rendered lighter in tint by the addition of acids and changed to purplish-red on the addition of alkalies.

Tests for Identity and Purity.—Agitate 2 Gm. of Cudbear occasionally with 200 mils of water during thirty minutes and then filter; the deep red-colored filtrate conforms to the following tests: Add to 5 mils of the filtrate 5 drops of glacial acetic acid and boil for one minute; then add 5 drops of stannous chloride T.S., and boil again for one minute; the liquid is only faintly pink (*brazilwood or logwood* which produces solutions of a deep red color); add 25 Gm. of kaolin to 100 mils of the filtrate in an Erlenmeyer flask, shake frequently during one hour and then filter; the filtrate is almost entirely decolorized in comparison with some of the original filtrate (*a number of coal tar colors*).

Cudbear yields not more than 25 per cent. of ash, consisting mainly of sodium chloride.

N. F. Preparations.—It is used to color the following: Elixir Ammonii Valeratis (from Compound Tincture); Elixir Aromaticum Rubrum; Elixir Cinchonæ Alkaloidorum (from Compound Tincture); Elixir Quininæ Valeratis et Strychninæ (from Compound Tincture); Elixir Strychninæ Valeratis (from Compound Tincture); Elixir Trium Bromidorum; Liquor Antisepticus Alkalinus; Syrupus Bromidorum (from Compound Tincture); Syrupus Phosphatum Compositus (from Tincture); Syrupus Pini Strobi Compositus; Syrupus Pini Strobi Compositus cum Morphina; Tinctura Persionis; Tinctura Persionis Composita.

Uses.—It is used as a red color in elixirs, syrups, etc. (see official preparations). Because of the difficulty of extracting it with liquid solvents, and the consequent lack of uniformity in the coloring power of the tincture, the drug, in most cases, is now added directly to the preparations, and, after maceration, the preparation filtered.

Gums and Mucilaginous Substances

The proximate principle *arabin* (formerly termed gum) may be described as a vegetable substance, which forms with water a thick glutinous liquid, is insoluble in alcohol, and, when treated with nitric acid, is converted into mucic and oxalic acids. Three proximate principles are found in gums: 1. *Arabin*, or arabic acid, $C_{12}H_{22}O_{11}$, the soluble form, found largely in acacia. 2. *Bassorin*, $C_{12}H_{20}O_{10}$, or insoluble gum, found in tragacanth. 3. *Cerasin* (insoluble), found in cherry gum.

Some exudations are composed of both soluble and insoluble gum. Vegetable mucilage and insoluble gum are carbohydrates usually produced by the disorganization of a portion of the cell-wall of plants or by changes in the cell contents. *Gums* differ from *starch*, or *cellulin*, by being soluble in water, or by swelling up in contact with it. They differ from sugars by being incapable of vinous fermentation with yeast. There will be frequent occasion to refer to the uses of gum in the subsequent chapters.

ACACIA. U. S. Acacia

[**Acac.**—GUM ARABIC]

The dried gummy exudation of *Acacia Senegal* Willdenow, and of other African species of *Acacia* (Fam. *Leguminosæ*).

Official Description.—In ovoid, more or less spheroidal tears, or in broken, angular fragments from 2 to 30 mm. in diameter, varying from white or yellowish-white to light amber-colored; translucent; very brittle; fractured surface glass-like, sometimes iridescent.

Odor and Taste.—Nearly inodorous; taste insipid, mucilaginous.

Solubility.—Insoluble in alcohol; slowly and almost completely soluble in twice its weight of water, forming a mucilaginous liquid, which has a slight, characteristic odor and is acid to litmus.

Tests for Identity and Purity.—When either 0.1 mil of basic lead acetate T.S., or 0.1 mil of a concentrated solution of sodium borate, or 0.1 mil of ferric chloride T.S. is added to 10 mils of a 10 per cent. aqueous solution of Acacia, a gelatinous precipitate is produced.

Tannin.—The precipitate produced with ferric chloride T.S. is neither black nor brownish-black.

The powder is whitish, with few or no starch grains or fragments of vegetable tissues.

Plant Tissues, Sand, or Dirt.—Not more than 1 per cent. of powdered Acacia is insoluble in water.

Acacia yields not more than 4 per cent. of ash, and the powder contains not more than 15 per cent. of moisture.

U. S. P. Preparations.—It is used in the following: Mucilage Acaciæ; Syrupus Acaciæ; Emulsum Amygdalæ; Emulsum Olei Morrhuæ; Emulsum Olei Terebinthinæ; Mistura Cretæ (from Compound Chalk Powder); Mistura Glycyrrhizæ Composita; Pilulæ Ferri Iodidi; Pilulæ Phosphori; Pulvis Cretæ Compositus; Trochisci Cubebæ.

N. F. Preparations.—Emulsum Olei Morrhuæ cum Calcii Lactophosphate; Emulsum Olei Morrhuæ cum Calcii Phosphate; Emulsum Olei Morrhuæ cum Hypophosphitibus; Emulsum Olei Morrhuæ cum Pruno Virginiana; Emulsum Olei Ricini; Emulsum Petrolati; Mistura Copaibæ (from Mucilage); Mistura Copaibæ et Opii (from Mucilage); Syrupus Morphinæ et Acaciæ (from Syrup); Trochisci Phenolphthaleini.

This valuable gum consists mainly of arabic acid, or arabin, combined with lime, potassium, or magnesium, and hence it may be called calcium, potassium, or magnesium arabate. It is bleached by exposure to the sun. In powder it is always white. The specific gravity varies from 1.31 to 1.525 for the dried gum.

One hundred parts of diluted alcohol containing 22 per cent. of alcohol by volume dissolve fifty-seven parts of gum; diluted alcohol containing 40 per cent. of alcohol takes up ten parts, while 50 per cent. alcohol dissolves only four parts.

Neutral lead acetate does not precipitate its aqueous solution, but the basic acetate forms a precipitate even in very dilute solution. Soluble silicates, borates, and ferric salts render a solution of the gum turbid, or thicken it to a jelly. No alteration is produced by silver salts, mercuric chloride, or iodine. Gum arabic dissolves in an ammoniacal solution of cupric oxide.

Uses.—In pharmacy, acacia is extensively used for the suspension of insoluble substances in water, and for the formation of pills and troches. Two kinds of powdered acacia are used, one a coarse powder called *granulated*, the other *finely dusted*. The granulated dissolves more readily in water, because it has lost during desiccation only a part of its moisture, while in preparing the "finely dusted" powder, the high heat necessarily used to dry it thoroughly drives off nearly all the water. Its easy solubility and its absence of tendency to form "lumps" cause the coarse powder to be preferred for solutions, emulsions, etc. Acacia is used as a binding agent in emulsions, pills, troches, etc. (see official preparations).

TRAGACANTHA. U. S. Tragacanth

[**Trag.**—Gum Tragacanth]

The spontaneously dried gummy exudation from the stems of *Astragalus gummifer* Labillardière, or from other Asiatic species of *Astragalus* (Fam. *Leguminosæ*).

Official Description.—In flattened, lamellated fragments varying from ribbon-shaped bands to long and linear pieces, which may be either straight or spirally twisted and from 0.5 to 2.5 mm. in thickness; whitish to light brown in color, translucent, and horny; fracture short; rendered more easily pulverizable by heating to 50° C. (122° F.).

Odor and Taste.—Inodorous; taste insipid, mucilaginous.

Tests for Identity and Purity.—Under the microscope, sections made from Tragacanth, previously softened in water, and mounted in glycerin, show the lamellæ of mucilaginous walls and a few starch grains, the latter being mostly spherical and single, occasionally 2- to 3-compound, the individual grains from 0.003 to 0.025 mm. in diameter and colored blue with iodine. Indian Gum, derived from plants of uncertain origin, upon similar treatment and examination, shows numerous threads of a granular substance, sometimes the hyphæ of a fungus and chains of bacteria, and occasional fragments of a yellowish-brown or reddish-brown color, containing lignified wood-fibers, a few rosette aggregates of calcium oxalate, from 0.02 to 0.03 mm. in diameter, and a few spherical starch grains, from 0.003 to 0.007 mm. in diameter.

Add 1 Gm. of Tragacanth to 50 mils of distilled water; it swells and forms a smooth, nearly uniform, stiff, opalescent mucilage free from cellular fragments. Indian Gum upon similar treatment forms an uneven mucilage containing a few reddish-brown fragments, and on stirring separates in the form of coarse, uneven strings.

Foreign Gums.—Shake 2 Gm. of Tragacanth with 100 mils of water until fully swollen and free from lumps, and then add 2 Gm. of powdered sodium borate and shake the mixture thoroughly until the salt is dissolved; the mucilage does not lose its transparency nor exhibit any change in consistence, and on pouring is not slimy or stringy, even after standing twenty-four hours.

Indian Gum.—Boil 1 Gm. of Tragacanth with 20 mils of water until a mucilage is formed, then add 5 mils of hydrochloric acid and again boil the mixture for five minutes; it develops no pink or red color.

The powder is whitish; forming with water a translucent mucilage and under the microscope exhibiting numerous starch grains, from 0.003 to 0.025 mm. in diameter, varying from spherical to elliptical, with occasional 2- to 4-compound grains, many of the grains being swollen and more or less altered, due to the drying of the Tragacanth before powdering. Powdered Indian Gum shows numerous fragments of lignified vegetable tissue.

Tragacanth yields not more than 3.5 per cent. of ash.

U. S. P. Preparations.—It is used in the following: Mucilago Tragacanthæ; Pilulæ Ferri Carbonatis; Trochisci Acidi Tannici; Trochisci Ammonii Chloridi; Trochisci Potassii Chloratis.

N. F. Preparations.—Emulsum Olei Morrhuæ cum Malto; Glyceritum Tragacanthæ; Stili Acidi Salicylici Dilubiles; Trochisci Carbonis Ligni; Trochisci Gambir; Trochisci Menthæ Piperitæ (from Mucilage); Trochisci Quininæ Tannatis; Trochisci Santonini; Trochisci Santonini Compositi; Trochisci Sulphuris et Potassii Bitartratis; Trochisci Ulmi.

This gum upon analysis was found to consist of 33 per cent. of bassorin, or insoluble gum, 53 per cent. of soluble gum (not arabin), 11 per cent. of water, and 3 per cent. of impurities. Its specific gravity is 1.384. Introduced into water, it absorbs a certain proportion of that liquid, swells very much, and forms a soft adhesive paste, but does not dissolve. If agitated with an additional quantity of water, this paste forms a uniform mixture; but in the course of one or two days the greater part separates, and is deposited, leaving a portion dissolved in the supernatant fluid. Tragacanth is wholly insoluble in alcohol. It appears to be composed of two different constituents, one soluble in water and resembling acacia, the other swelling in water, but not dissolving. The former differs from acacia in affording no precipitate with potassium silicate or ferric chloride. A common adulteration is *Indian Gum*, to exclude which the Pharmacopœia has introduced several tests.

Uses.—Tragacanth, in the form of a glycerite, affords an excellent pill excipient; the powder itself is often used to stiffen a pill mass and render it adhesive. The list of official preparations is given above.

ULMUS. U. S. Elm

[ELM BARK SLIPPERY ELM]

The bark of *Ulmus fulva* Michaux (Fam. *Ulmaceæ*), deprived of the outer corky layer and dried.

Official Description.—Usually in bundles consisting of flat, oblong pieces, about 30 cm. in length and from 10 to 15 cm. in width; outer surface of a light brown or buff color with occasional dark brown patches of adhering cork, longitudinally striate and with detachable bundles of bast-fibers, and colored blackish upon the addition of a very diluted iodine T.S.; inner surface light yellowish-brown, nearly smooth and finely striate, only slightly darkened upon the addition of a very diluted iodine T.S.; fracture fibrous with projecting bast-fibers, the broken surface porous, due to the large mucilage cells.

Odor and Taste.—Odor distinct; taste mucilaginous.

Tests for Identity.—The powder is very light brown; under the microscope it shows mostly fibrous fragments, and a finely granular portion made up of small starch grains, the latter being immediately colored bluish-black upon the addition of iodine T.S.; starch grains mostly spherical or more or less polygonal, usually about 0.003 mm. in diameter, but also attaining a diameter of 0.025 mm.; bast-fibers very long, about 0.02 mm. in diameter, with rather thin, slightly lignified walls; calcium oxalate in monoclinic prisms, mostly in crystal fibers, the individual crystals from 0.01 to 0.025 mm. in diameter; fragments of large mucilage cells with adhering starch grains.

Macerate 1 Gm. of powdered Elm with 40 mils of distilled water for an hour and forcibly strain; the solution is of a mucilaginous consistence.

N. F. Preparation.—Trochisci Ulmi.

This bark contains a mucilage which is capable of being precipitated from its aqueous solution by alcohol and lead acetate. It is much used as a demulcent.

ALTHÆA. U. S. Althæa

[MARSH MALLOW ROOT]

The root of *Althœa officinalis* Linné (Fam. *Malvaceœ*) deprived of the brown, corky layer and small roots, and carefully dried. Preserve Althæa in tightly-closed containers, adding a few drops of chloroform or carbon tetrachloride from time to time, to prevent attack by insects.

Official Description.—Usually cut into small pieces about 5 mm. in diameter, of a uniform grayish-white color and otherwise having the characters of entire roots; occasionally entire, slenderly tapering, attaining a length of 30 cm. and a thickness of 2 cm.; externally whitish, longitudinally furrowed, frequently spirally twisted and covered with the somewhat loosened bast-fibers; fracture of bark fibrous, of wood short and granular; internally yellowish-white; bark 1 to 2 mm. thick, porous, due to mucilage cells, and separated from the slightly radiating wood by a distinct, grayish cambium zone.

Odor and Taste.—Odor slight; taste sweetish, mucilaginous.

Tests for Identity and Purity.—The powder is whitish; starch grains numerous, from 0.003 to 0.02 mm. in diameter, usually with a long cleft at the point of origin of growth; sclerenchymatous fibers in groups, the walls being quite thick and more or less lignified; tracheæ with scalariform thickenings or with bordered pores; calcium oxalate crystals few, in rosette aggregates from 0.02 mm. to 0.03 mm. in diameter.

Add 1 Gm. of Althæa to 10 mils of cold water, allow it to stand with occasional stirring during thirty minutes, and filter through cotton; a pale yellow-colored mucilage is obtained, which is neutral to litmus and is deep yellow on the addition of a few drops of potassium hydroxide T.S. The mucilage does not have a sour or ammoniacal odor.

Althæa yields not more than 8 per cent. of ash.

U. S. P. Preparations.—Massa Hydrargyri; Pilulæ Ferri Carbonatis; Pilulæ Phosphori.

N. F. Preparations.—Species Pectorales; Syrupus Althææ.

This root, which is generally imported from Europe, contains a large quantity of mucilage, $C_{12}H_{20}O_{10}$, associated with *asparagin,* sugar, and starch. It is used as a demulcent and as a filler for pill masses (see the official preparations above). The leaves are official in the N. F.

LINUM. U. S. Linseed

[FLAXSEED]

The ripe seeds of *Linum usitatissimum* Linné (Fam. *Linaceœ*), without the presence or admixture of more than 3 per cent. of other seeds or foreign matter. Preserve it in tightly-closed containers and add a few drops of carbon tetrachloride or chloroform from time to time to prevent attack by insects.

Official Description.—Ovate or oblong-lanceolate, flattened, obliquely pointed at one end, from 3 to 5 mm. in length; externally chestnut-brown, very smooth and shiny, the raphe extending as a distinct, light-yellow ridge along one edge; easily cut with the finger-nail; internally olive-green; oily.

Odor and Taste.—Odor slight; taste mucilaginous and oily.

Tests for Identity and Purity.—Under the microscope, transverse sections of Linseed when mounted in hydrated chloral T.S. show an epidermis with a mucilaginous layer from 0.01 to 0.03 mm. in thickness, covered by a very thin layer of cutin which is often more or less broken; two layers of parenchyma which overlie a continuous ring of stone cells having yellowish, porous walls and rather large lumina; a pigment layer, the cells having a reddish-brown content; an endosperm consisting of from 6 to 10 rows of cells surrounding the two large plano-convex cotyledons; the cells of both the endosperm and the cotyledons contain a fixed oil and aleurone grains, the latter being from 0.003 to 0.02 mm. in diameter.

The powder is lemon-yellow or light brown, consisting chiefly of large, oily globules and irregular fragments of endosperm and seed-coat; the seed-coat is characterized by the tabular pigment cells filled with a reddish-brown, insoluble content and the somewhat elongated stone cells with yellowish walls; mounts made from material from which the fixed oil has been removed show aleurone grains from 0.003 to 0.02 mm. in diameter, both free and in the cells of the endosperm and embryo.

Linseed Meal or Flaxseed Meal is light olive-brown with reddish-brown fragments; the latter very coarse and the cellular tissues are the same as those of the powder.

Powdered Linseed or Flaxseed and Linseed Meal or Flaxseed Meal must be free from any unpleasant or rancid odor.

The powder, upon extraction with purified petroleum benzin, yields not less than 30 per cent. of a fixed oil, at least 98 per cent. of which is saponifiable.

Boil 1 Gm. of the fat-free Linseed or Flaxseed Powder or Meal, with 50 mils of water, cool and filter; the filtrate gives not more than a faint blue color, on the addition of iodine T.S.

Linseed yields not more than 6 per cent. of ash.

N. F. Preparation.—Species Emollientes.

Linseed contains 15 per cent. of mucilage, $C_{12}H_{20}O_{10}$, in the epithelium, and from 20 to 35 per cent. of fixed oil in the nucleus, besides resin, sugar, wax, etc. The mucilage is soluble in water, but more readily in hot water, forming a thick, viscid liquid. Alcohol and lead subacetate precipitate it from its aqueous solution. The mucilage is an important constituent; the seed is used in its unground state for making a demulcent infusion. Ground flaxseed is very useful to the pharmacist for making lutes, and, medicinally, it is used for making poultices. The fixed oil is very valuable in the arts because of its drying properties. (See Oleum Lini.)

ALTHÆA FOLIA. N. F. Althæa Leaves

[**Althæ. Fol.**—Marsh Mallow Leaves]

The dried leaves of *Althæa officinalis* Linné (Fam. *Malvaceæ*), without the presence of more than 5 per cent. of stems or other foreign matter.

Official Description.—Gray-green or yellowish gray-green and densely and finely tomentose throughout; petioles one-sixth to one-fifth as long as the blades; blades varying from 5 to 15 cm. in length and from 3 to 10 cm. in breadth, cordate or rhomboidal-ovate in outline, rounded or occasionally nearly truncate at the base, acute at the summit; margin doubly serrate-dentate, the principal teeth from one to three pairs, the lowest almost large enough to be regarded as lobes, the secondary very irregular, triangulate, acute, broader than long, the sinuses acute; two to four or occasionally six principal veins originating with the midrib in the petiole, prominent underneath, terete; branches of the midrib arising at a wide angle, nearly straight, each terminating in a marginal tooth. Leaf thin, but appearing thick because of its hairy covering.

Odor and Taste.—Odor slight, scarcely characteristic; taste mucilaginous.

Tests for Identity and Purity.—The powdered drug is grayish to grayish-green and, when examined under the microscope, exhibits numerous unicellular, non-lignified, stellate branching hairs, up to 0.6 mm. in length, usually occuring in clusters of two to six; few, short-stalked, multicellular glandular hairs; calcium oxalate in rosette aggregates up to 0.025 mm. in diameter; fragments of epidermal tissue with stomata, the latter about 0.025 mm. in length; few lamellated mucilage cells; usually a few pollen grains, spherical, spiny, up to 0.1 mm. in diameter.

Althæa Leaves yield not more than 16 per cent. of ash.

N. F. Preparation.—Species Emollientes.

Uses.—Used as a demulcent, emollient and protective in doses of about thirty grains (2 Gm.).

DEXTRINUM ALBUM. N. F. White Dextrin
[Dext. Alb.]

A mixture of soluble carbohydrates, amylodextrin, achroodextrin, erythrodextrin and maltodextrin, together with a variable amount of unconverted starch, obtained by the incomplete hydrolysis of starch by the action of an acid.

Official Description.—It occurs as a white, glistening, non-hygroscopic, amorphous powder producing a peculiar and characteristically harsh sensation when rubbed in the hand.

Odor and Taste.—Odorless and having a sweetish taste.

Solubility.—Only partly soluble in cold water, but completely soluble in three parts of water on boiling.

Tests for Identity and Purity.—An aqueous solution prepared in the cold and filtered is colored wine-red by iodine T.S.; an aqueous solution prepared with boiling water is colored blue by iodine T.S.

Alkaline cupric tartrate V.S. is not changed by a solution of White Dextrin in the cold, but is reduced on boiling.

Oxalic Acid.—Separate portions of a freshly prepared, filtered solution in cold water do not become turbid on the addition of calcium chloride T.S. or of calcium hydroxide T.S.

Dextrose.—Not more than 5 per cent. of White Dextrin is soluble in boiling alcohol.

Moisture.—Dry White Dextrin at 110° C. (230° F.); it loses not more than 10 per cent. in weight.

Separate portions of a filtered aqueous solution of White Dextrin (1 in 20) are not immediately precipitated by lead acetate T.S., or by basic lead acetate T.S., but upon the addition of a few drops of ammonia water to the mixtures, precipitation occurs (difference from *natural gums*).

Metals.—A solution of White Dextrin does not darken on the addition of hydrogen sulphide T.S. even when supersaturated with ammonia water.

White Dextrin yields not more than 0.5 per cent. of ash.

N. F. Preparations.—Pasta Dextrinata; Stili Acidi Salicylici Dilubiles.

Uses.—Used as the basis for dermatological pastes and commercially, on a large scale, for the making of *library paste*.

FUCUS. N. F. Fucus
[BLADDERWRACK]

The dried thallus of *Fucus vesiculosus* Linné (Fam. *Fucaceæ*).

Official Description.—Sometimes a meter in length, but usually in shorter pieces from 1 to 4 cm. in width, dichotomously branched, brownish black, usually with a slight, whitish incrustation; flat, smooth, entire-margined, having a stout midrib throughout, along which are irregularly disposed pairs of air-vesicles which vary in diameter from 5 to 15 mm.; receptacles terminal, compressed, mostly ovate or elliptical and about 1 cm. in length, but varying from spherical and 5 mm. in diameter to linear-lanceolate and 5 cm. in length, forked, solitary, or in pairs.

Odor and Taste.—Odor strongly seaweed-like; taste saline and nauseous.

Fucus yields not more than 20 per cent. of ash.

N. F. Preparation.—Fluidextractum Fuci.

Uses.—It is used as an alterative in doses of ten grains (0.6 Gm.).

GALEGA. N. F. Galega
[Galeg.—EUROPEAN GOAT'S RUE]

The dried flowering tops of *Galega officinalis* Linné (Fam. *Leguminosæ*).

Official Description.—Stem smooth, erect, branched, when entire from 15 to 45 cm. in length, commonly cut and broken; leaves oddly-pinnate with from six to eight pairs of leaflets; stipules lanceolate, sagittate on one side; leaflets bright green, smooth or slightly hairy, short petioled, lanceolate or ovate-lanceolate, obtuse, slightly mucronate from 2 to 5 cm. in length and from 2 to 6 mm. in breadth; flowers small, white to violet, in axillary racemes. It colors the saliva yellowish-green.

Odor and Taste.—Odor indistinct, taste mucilaginous, slightly bitter and astringent. Galega yields not more than 12 per cent. of ash.

N. F. Preparation.—Fluidextractum Galegæ.

Uses.—It is used as a diaphoretic and galactagogue in doses of sixty grains (4 Gm.).

MALVÆ FOLIA. N. F. Mallow Leaves

[Malv. Fol.]

The dried leaves of *Malva sylvestris* Linné and of *Malva rotundifolia* Linné (Fam. *Malvaceœ*). Reject leaves showing brown fungous growths of *Puccinia Malvacearum* Montagne.

Official Description.—Leaves of *Malva sylvestris*, petiolate with petioles up to 10 cm. in length, orbicular or reniform, slightly truncate or cordate at the base, from 10 to 11 cm. in length, and from 15 to 20 cm. in width, with three to seven shallow, angular or rounded lobes, venation palmate, margins crenate-dentate, pubescent on both sides. Leaves of *Malva rotundifolia*, with petioles up to 20 cm. in length, orbicular up to 8 cm. in width, base deeply cordate, five to seven shallow rounded lobes, venation palmate, margins with rounded blunt teeth, pubescence more scant than *M. sylvestris*. Intermixed with the leaves are frequently found dark purple flowers and glabrous reticulated carpels (*M. sylvestris*) or pale bluish flowers and pubescent rounded carpels (*M. rotundifolia*).

Odor and Taste.—Inodorous; on chewing it becomes very mucilaginous, taste bland.

Tests for Identity and Purity.—When examined under the microscope, sections show an epidermis containing mucilage cells; numerous stomata, on both surfaces, each with three or four neighboring cells; trichomes of three distinct types, small, short-stalked glandular hairs, single, large, one-celled curved hairs with thick walls and compound or stellate hairs in groups of two- to six-cells (the latter especially numerous in *M. sylvestris*); palisade tissue of one or two rows of cells, the mesophyll of three or four rows; the parenchyma containing calcium oxalate in rosette crystals and numerous mucilage cells which are distributed in the tissue of the veins; veins with collateral bundles.

The powder is light green and, when examined under the microscope, exhibits the characteristic hairs, mucilage cells, epidermis with stomata, and rosette crystals of calcium oxalate.

Mallow Leaves yield not more than 16 per cent. of ash.

N. F. Preparation.—Species Emollientes.

Uses.—It is used as an emollient and demulcent.

SASSAFRAS MEDULLA. N. F. Sassafras Pith

(U.S.P. VIII)

[Sassaf. Med.]

The dried pith of *Sassafras variifolium* (Salisbury) O. Kuntz (Fam. *Lauraceœ*).

Official Description.—In sub-cylindrical, often curved or coiled pieces, from 2 to 10 cm. in length and from 2 to 5 mm. in diameter; very light in weight, externally whitish, occasionally with small fragments of adhering wood; fracture short.

Odor and Taste.—Odor slight, sassafras-like; taste mucilaginous.

Tests for Identity.—When examined under the microscope, transverse sections of Sassafras Pith, mounted in phloroglucinol T.S. and hydrochloric acid, show nearly isodiametric cells with large intercellular spaces, the walls being more or less lignified and provided with numerous, simple pores; mounts made in water show the separation of a thin layer of mucilage from the inner walls of the cells, characterized by the gradual disappearance of the pores.

Macerate 0.5 Gm. of Sassafras Pith with 25 mils of cold distilled water for several hours and filter it through purified cotton; a mucilaginous solution is obtained which does not give a precipitate upon the addition of an equal volume of alcohol.

N. F. Preparation.—Mucilago Sassafras Medullæ.

Uses.—The pith contains a delicate mucilage which is not precipitated from its aqueous solution by alcohol. The mucilage is principally employed as an eye wash.

VERBASCI FLORES. N. F. Mullein Flowers

[Verbasc. Flor.]

The dried corollas, with adhering stamens, of *Verbascum phlomoides* Linné or of *Verbascum thapsiforme* Schraeder (Fam. *Scrophulariaceæ*). Preserve the flowers in tightly-closed containers.

Official Description.—Corolla light-yellow, the outer surface grayish with a fine, soft, woolly indumentum, the inner surface sparsely hairy and finely veined; tube of the corolla only 1 or 2 mm. in length and almost equally broad, the limb from 14 to 30 mm. in breadth, between wheel-shaped and saucer-shaped, obscurely two-lipped, the unequal lobes rounded-obovate. Stamens five, borne on the base of the corolla, shorter than the corolla, two of them longer than the other three, the filaments thick and fleshy, more or less pilose, especially the three shorter ones, usually orange colored. Stamen-hairs cylindrical, unicellular, non-branching, surface minutely reticulate, apex rounded, frequently enlarged. Pollen grains smooth, triangular and more or less rounded, from 0.025 to 0.03 mm. in diameter.

The flowers impart a yellow color to boiling water, and a rather permanent green color with dilute sulphuric acid, the latter color becoming brown upon the addition of alkalies.

Odor and Taste.—Odor peculiar, agreeable; taste mucilaginous, not agreeable.

Mullein Flowers yield not more than 6 per cent. of ash.

N. F. Preparation.—Species Pectorales.

Uses.—As a demulcent and expectorant. Dose two drachms (8 Gm.).

VERBASCI FOLIA. N. F. Mullein Leaves

[Verbasc. Fol.]

The dried leaves of *Verbascum Thapsus* Linné (Fam. *Scrophulariaceæ*) and of other species of *Verbascum*.

Official Description.—Obovate with narrowed base, or varying to oblong or oblong-lanceolate, without a true petiole, obtuse or tending toward acuteness at the summit, from 1 to 6 dm. in length and from 3 to 15 cm. in breadth; very thick, rather tough, light yellowish-gray or greenish-gray, densely long-tomentose, with numerous, multicellular, branching, non-glandular hairs.

Odor and Taste.—Nearly odorless; taste mucilaginous and slightly bitter.

Verbascum yields not more than 14 per cent. of ash.

N. F. Preparation.—Fluidextractum Verbasci Foliæ.

Uses.—As a demulcent and expectorant. Dose one drachm (4 Gm.).

Unofficial Mucilaginous Substances

Bael-fruit	The dried, half ripe fruit of *Ægle Marmelos*. Fam. Aurantiaceæ. Habitat, Himalaya Mountains. Used principally in dysentery. Dose of fluidextract, 1 to 2 fluidrachms
Baobab	From *Adansonia digitata*. Fam. Sterculiaceæ. Habitat, Tropical Africa. Used as a tonic
Benne Leaves	From *Sesamum Indicum*. Fam. Pedaliaceæ. Habitat, India. Used as a stimulant
Blue-weed	From *Echium vulgare*. Habitat, Europe. Used chiefly as an emollient and protective
Borage	From *Borago officinalis*. Fam. Boraginaceæ. Habitat, Southern Europe. Used chiefly as an emollient and protective
Cashew-nut	From *Anacardium occidentale*. Fam. Terebinthaceæ. Habitat, Tropical America. Used externally and as a vermifuge
Comfrey-root	The root of *Symphytum officinale*. Fam. Boraginaceæ. Habitat, Europe. Used as a demulcent and astringent

Cydonium, Quince Seed	The seed of *Cydonia vulgaris*. Fam. Rosaceæ. Used for *Mucilago Cydonii*, 2 per cent. quince seed, 98 per cent. water
Evening Primrose	From *Ænothera biennis*. Fam. Onagraceæ. Habitat, North America
Fenugreek	The seeds of *Trigonella Fœnum-græcum*. Fam. Leguminosæ. Habitat, Western Asia. Used as an emollient, and in condition powders
Hog Gum	From *Rhus metopium*. Habitat, South America. Used as a demulcent
Hound's Tongue	From *Cynoglossum officinale*. Habitat, Europe and United States. Used as an emollient and protective
Jujube Berries	The fruit of *Zizyphus vulgaris*. Fam. Rhamnaceæ. Habitat, Asia Minor. Used as a laxative
Laminaria	From *Laminaria Cloustonia*. Fam. Algæ. Habitat, North Atlantic Ocean
Lungwort	From *Pulmonaria officinalis*. Habitat, Europe
Maidenhair	The fronds of *Adiantum Capillus-Veneris*. Fam. Filices. Used as a demulcent and stimulant
Mezquite Gum	From *Algarobia glandulosa*. Habitat, Texas
Okra	From *Hibiscus esculentus*. Habitat, Africa
Salep	From the tubers of *Orchis mascula*. Is very mucilaginous, only four grains being sufficient to make one fluidounce of water gelatinous
Virginia Lungwort	From *Pulmonaria Virginica*. Habitat, United States
Willow Herb	From *Epilobium angustifolium*. Fam. Onagraceæ. Used as a tonic and demulcent

QUESTIONS ON AMYLACEOUS AND MUCILAGINOUS PRINCIPLES AND THEIR PRODUCTS

What is starch? (See page 1021.) Give the Latin official name and description.
What is its chemical composition?
What are the official preparations of starch?
For what is starch used? Describe odor, taste, chemical reaction, and solubility. Give tests for identity and purity.
How is it made?
What is gluten?
Upon what is the purity of starch largely dependent?
What change takes place when starch is subjected to the action of diluted acids, diastase, or heat?
Under what names is dextrin largely used in the arts? Describe its appearance.
How may it be distinguished from gum arabic.
In what solutions is starch soluble?
What is the composition of inulin?
Where is it found?
In what particular does it differ from starch?
From what other sources is unofficial starch derived?
Malt—What is the source? By what means is its value determined? What is the U. S. P. standard of activity? Describe its appearance, odor, and taste. Give tests for identity and purity. Describe the process by which it is made. What active constituent is present?
For what is it used? What is the official preparation?
Diastase—What is this substance?
What is the U. S. P. standard of strength? How is this determined?
How may diastase be prepared?
Describe its appearance, odor, taste, and solubility. What are its uses and the dose?
Chondrus—Give the Latin official name and synonyms. What is its source?
What principle does it contain?
Wherein does this principle differ from gum? From starch? From pectin?
For what is chondrus used?
Chondrus gelatin—What is the Latin title? Give the synonym. How is it prepared? What are its uses?
Agar—What is the synonym? What is its source?
Describe its appearance, odor, and taste. Give tests for identity and purity.
For what is it used?
Cudbear—What is the Latin title?
What is cudbear? How is it prepared?
Describe its appearance and tests for identity and purity.
For what is it used?
What is arabin?
What three proximate principles are found in gums?
In what gums are these principles found?

Wherein do gums differ from starch or cellulin?
Wherein do gums differ from sugars?
Gum arabic—What are the Latin and English official names? What is this drug? Describe appearance, odor, and taste.
Give the solubility and tests for identity and purity.
Of what does this gum mainly consist?
Does neutral lead acetate precipitate its aqueous solution?
Does basic lead acetate precipitate its aqueous solution?
What action is produced by soluble silicates, borates, or ferric salts?
What are its uses in pharmacy?
What are the official preparations of acacia?
Tragacanth—What is the Latin official name? Whence obtained?
Describe its appearance, odor, and taste.
Give tests for identity and purity.
What are its constituents? What is its specific gravity?
What color is produced when iodine T.S. is added to mucilage of tragacanth?
Wherein does the portion soluble in water differ from acacia?
What official preparations are there of tragacanth?
Elm—What is the Latin official name? What are the synonyms? Of what tree is this the bark?
Describe its appearance, odor and taste. Give tests for identity and purity.
What does the bark contain? For what is it used?
What official preparation is there of it?
Althæa—What is the Latin official name and synonym? What part is official in the U. S. P.?
What is its source?
Describe its appearance, odor, and taste. Give tests for identity and purity.
What does it contain, and for what is it used?
Linseed—What is the Latin official name? What is the synonym? Whence obtained?
Describe its appearance, odor and taste. Give tests for identity and purity.
What does it contain?
What percentage of a fixed oil should be present?
For what purposes is it used?
Why is the fixed oil especially valuable?
Althæa leaves—What is the Latin title? The synonym? How is it described in the N. F.? What are its uses and the dose?
White dextrin—What is this substance and how prepared?
Describe its appearance, odor, taste and solubility.
Give tests for identity and purity. For what is it used?
Fucus—What is its Latin title? The synonym?
What is fucus? Describe its appearance, odor, taste and use.
Galega—What is its synonym? Give the N. F. definition.
Describe its appearance, odor, and taste. What are its uses?
Mallow leaves—What is the official definition?
Describe its appearance, odor and taste. What are its microscopic characteristics?
What are its uses?
Sassafras pith—What is this drug?
Describe its appearance, odor and taste. What are its microscopic characteristics? Name its official preparations. What constituent is present and what is its peculiarity?
Mullein flowers—What is the source of this drug?
Describe its appearance, odor and taste. Name its N. F. preparation. Give uses and dose.
Mullein leaves—What is its source? Give appearance, odor, taste and uses.
Name important official substances containing mucilage.

CHAPTER LI

SUGARS AND SACCHARINE SUBSTANCES

SUGARS may be defined as organic bodies having a sweet taste, generally of vegetable origin and crystallizable, of a neutral reaction, soluble in water, their solutions being optically active to polarized light. The term sugar is popularly applied to but one product, saccharose, the sweet substance obtained from sugar cane, beets, sorghum, sugar maple, etc. There are, however, many sugars, chemically spoken of as *carbohydrates*, varying not only in external appearance and properties, but also in chemical composition. The group of the carbohydrates has been studied by Emil Fischer, who has not only made numerous syntheses in this group, but has greatly widened our knowledge of the relations of the several sugars, making necessary a comprehensive classification. Thus, while no sugars are found in nature containing less than six atoms of carbon, synthetic compounds are formed belonging in the first or monosaccharide class which contain three, four, and five atoms of carbon, as well as others containing seven, eight, and nine atoms of carbon. The nomenclature of the sugars is based upon the fact that simple sugar molecules are known which are distinguished by the Greek prefixes, tri, tetra, etc., indicating the number of carbon atoms in the molecule; thus, glycerose, $C_{.}H_6O_3$, is a triose, while dextrose, $C_6H_{12}O_6$, is a hexose. These are called monoses. These simple sugar molecules are taken as the basis for a secondary classification based upon the number of monoses or simple sugar molecules represented in the molecular structure of the more complex members of the group. The Greek numerical prefixes are also used to distinguish these; thus, dextrose, $C_6H_{12}O_6$, is a *monosaccharid*, while sucrose, $C_{12}H_{22}O_{11}$, is a *disaccharid* produced by the union of two monosaccharid molecules with the elimination of water. Of the simple sugars, members ranging from three to nine carbon atoms are known (*trioses* to *nonoses*), while of the broader groupings, *monoses*, *dioses*, *trioses*, (monosaccharids, etc.) contain respectively one, two or three of the simple sugar molecules, while *polyoses* or *polysaccharids* contain an indefinite or larger number of monoses. The classification given below, is based on that of Tollens.

I. *Monosaccharides*

Trioses	Prepared from glycerin by oxidation
Glycerose, $C_3H_6O_3$	
Tetroses	Prepared from erythrite by oxidation
Erythrose, $C_4H_8O_4$	
Pentoses	
Arabinose, $C_5H_{10}O_5$	Prepared by the action of dilute sulphuric acid upon lævorotatory gum arabic
Xylose, $C_5H_{10}O_5$	Prepared by boiling beech wood and jute with dilute acids
Rhamnose or Isodulcite, $C_5H_9(CH_3)O_5$, Methyl Pentose	Obtained in the decomposition of glucosides like quercitrin
Hexoses	
Glucose or Dextrose $C_6H_{12}O_6$	When crystallized, known as grape sugar, starch sugar, or *d*-glucose Prepared by treating starch with dilute acids (see page 1039)
Fructose or Levulose (Sucro-levulose, Mucoid Sugar or Fruit Sugar, Lævo-glucose), $C_6H_{12}O_6$	Rotates the plane of polarization strongly to the left. Found in the sugar cane, and may be obtained from molasses; found in honey and in fruits; obtained pure by the action of diluted acids on inulin
Mannose, $C_6H_{12}O_6$	Obtained by the careful oxidation of mannite
Galactose, $C_6H_{12}O_6$	Made by treating milk sugar with diluted sulphuric acid
Dulcitose	Obtained by oxidizing dulcite with nitric acid
Mannitose	Found in muscular flesh and made by the oxidation of mannite

Hexoses—(Continued).	
Arabinose, pectinose	Made by the action of diluted acid on arabin
Inosite, inosol, phaseomannite	Found in muscle, kidney beans, cochineal, etc.
Scyllite	Found in kidney, liver, etc., of cartilaginous fishes
Sorbinose, sorbin	Found in ripe mountain ash berries
Eucalyptose, eucalyn, $C_6H_{12}O + H_2O$	Made by the action of the diluted acids on, or fermentation of, mellitose
Heptoses, $C_7H_{14}O_7$,	Obtained artificially from the corresponding mannose
Manno-heptose	
Gluco-heptose	Obtained artificially from the corresponding glucose
Octoses, $C_8H_{16}O_8$,	Prepared from the corresponding mannose
Manno-octose	
Gluco-octose	Prepared from the corresponding glucose
Nonoses, $C_9H_{18}O_9$,	Prepared from the corresponding mannose
Manno-nonose	
Gluco-nonose	Prepared from the corresponding glucose

II. Disaccharides and Trisaccharides

Tribioses and *Tetrabioses*	Are as yet unknown
Pentabioses,	
Arabinon, $C_{10}H_{18}O_9$	Has been prepared by the moderated action of dilute sulphuric acid upon arabic acid
Hexabioses,	
Cane Sugar, $C_{12}H_{22}O_{11}$	Obtained from sugar cane, beets, etc. (see Saccharum)
Saccharose, Sucrose	
Milk Sugar, $C_{12}H_{22}O_{11}$ (Lactose, Lactin)	Obtained from milk (see Saccharum Lactis)
Maltose, $C_{12}H_{22}O_{11}$	Made by the action of diastase on starch
Isomaltose, $C_{12}H_{22}O_{11}$	
Trehalose, $C_{12}H_{22}O_{11}$	Obtained from the cocoons of *Larinus maculatus*
Parasaccharose	Produced by spontaneous fermentation of cane sugar
Mycose, $C_{12}H_{22}O_{11} + 2H_2O$	Obtained from ergot, mushrooms, and Trehala manna; identical with trehalose
Melitose, Eucalypton, $C_{12}H_{22}O_{11} + 3H_2O$	Obtained from various species of Eucalyptus, and from cotton seed
Synanthrose	Obtained from the Jerusalem artichokes, and from *Dahlia variabilis*
Hexatrioses,	Obtained from beet root
Meletriose or Raffinose, $C_{18}H_{32}O_{16}$	
Melezitose, $C_{18}H_{32}O_{16}$	Obtained from manna and the larch

III. Polysaccharides

(*a*) *Crystallizable Polysaccharides*	Gentianose, lactosin
(*b*) *Uncrystallizable Polysaccharides*	Starches, lichnin, inulin, glycogen, dextrin, natural gums, pectin substances, cellulose, lignin, tunicin

A group of related substances sometimes termed *saccharoids*, some having the chemical composition of glucose, are given below.

Mannite, Mannitol, or Alpha-Hexone alcohol, $C_6H_{14}O_6$	Obtained from Manna and many other plants, and from the reduction of glucose
Dulcite, or Dulcitol, or Beta-Hexone alcohol, $C_6H_{14}O_6$	Also called Melampyrite. Obtained from *Melampyrum memorosum*, and by the action of nascent hydrogen on galactose
Quercitose, $C_6H_{12}O_6$	By decomposing quercitrin with diluted sulphuric acid
Sorbite, $C_6H_{14}O_6 + \frac{1}{2}H_2O$	From *Sorbus aucuparia*,—mountain ash berries
Erythromannite, $C_4H_{10}O_4$	Obtained from *Protococcus vulgaris*, also called *Phycite*
Isodulcite, $C_6H_{14}O_6$	From quercitrin, by the action of diluted acids
Pinite, $C_6H_{12}O_5$	From *Pinus Lambertiana*
Quercite, $C_6H_{12}O_5$	Obtained from acorns
Persite, or Persitol, $C_6H_{14}O_6$	Obtained from *Laurus persea*
Hesperidin sugar, $C_6H_{14}O_6$	

GLUCOSUM. U. S. Glucose

[**Glucos.**—Syrupy Glucose Liquid Glucose]

A syrupy product obtained by the incomplete hydrolysis of starch, consisting chiefly of dextrose (*d*-glucose) [$C_6H_{12}O_6 = 180.10$] and dextrins.

Preparation.—Glucose, $C_6H_{12}O_6$, may be obtained from candied honey, from grapes, and from many other sources, but it is prepared from starch upon an immense scale by the action of very weak sulphuric acid or hydrochloric acid. The term glucose is applied to the syrupy product of this process, while the name *grape sugar* is applied to the solid product from the same source, which will be found among the Diagnostical Reagents, Chapter LXII. The process is as follows: The starch, usually from corn, is mixed with five times its weight of water containing one per cent. of sulphuric acid, the mixture, heated to about 45° C. (113° F.) and then transferred to a suitable lead-lined vessel into which steam is passed under pressure until the temperature reaches 160° C. (320° F.). By now allowing the steam to escape the empyreumatic oils are carried off, thereby eliminating the disagreeable odor. The temperature is now maintained at 80° C. (176° F.) until a test portion no longer gives a blue color with iodine T.S. or a precipitate with lead acetate, indicating absence of starch and complete saccharification. The mass is then transferred to the neutralizing vats, calcium carbonate is added to neutralize the sulphuric acid which precipitates as calcium sulphate, the liquid drawn off is filtered, then decolorized in charcoal or bone-black filters; as is done in sugar refining, and finally concentrated in vacuum to the desired consistence or to the crystallizing point. If " syrupy glucose " is desired, a little dextrin is left in the product to prevent crystallization.

Since the use of sulphuric acid usually introduces small amounts of calcium sulphate in the finished product, hydrochloric acid has largely replaced sulphuric acid for the hydrolysis of the starch, the excess being afterward volatilized. Glucose can be obtained as an hydroxide in small and laminated crystals from aqueous solution, and anhydrous in hard crystalline masses either from alcoholic solution or from very concentrated aqueous solution. It is less sweet than cane sugar. It is also less soluble in water, and much more soluble in alcohol. It has the specific gravity 1.54 to 1.57 when anhydrous. Strong mineral acids hardly act on grape sugar, but destroy cane sugar with facility. On the other hand, grape sugar is destroyed by alkalies, with which cane sugar forms definite compounds. Dissolved in water and subjected to prolonged ebullition, grape sugar undergoes very little alteration. Its solution rotates the plane of polarization of polarized light to the right, and is capable of undergoing the vinous fermentation directly, without passing through any intermediate state. It is characterized, also, in boiling solution, by reducing alkaline cupric tartrate (see Volumetric Solution of Alkaline Cupric Tartrate), producing a reddish precipitate. The official description is as follows:

Official Description.—It occurs as a colorless or slightly colored, thick, syrupy liquid.

Odor, Taste, and Reaction.—It is odorless or nearly so and has a sweet taste. An aqueous solution of Glucose is neutral or slightly acid to litmus.

Solubility.—It is very soluble in water, sparingly soluble in alcohol.

Tests for Identity.—Add a few drops of an aqueous solution of Glucose (1 in 20) to 5 mils of hot alkaline cupric tartrate T.S.; a copious red precipitate of cuprous oxide is produced (*distinction from cane sugar.*)

Impurities and Tests for Impurities.—*Water.*—Introduce about 0.5 Gm. of Glucose into a wide-mouthed, tared weighing-bottle, weigh accurately, add 2 mils of distilled water, evaporate the water at about 70° C. (158° F.) and dry the residue to constant weight at 90° C. (194° F.). The loss in weight of the Glucose does not exceed 21 per cent.

Incinerate Glucose at a temperature not exceeding a low red heat; not more than 1 per cent. of ash remains.

Free Acid.—A solution of 5 Gm. of Glucose in 15 mils of distilled water, mixed with 5 drops of phenolphthalein T.S., requires not more than 0.6 mil of tenth-normal potassium hydroxide V.S. to produce a pink color.

Starch.—Dissolve about 2 Gm. of Glucose in 50 mils of distilled water, boil the solution for one minute and cool; the addition of one drop of tenth-normal iodine V.S. to this solution produces no blue color.

Limit of Sulphur Dioxide.—On now adding a few drops of starch T.S. to the solution, a blue color is produced.

Heavy Metals.—An aqueous solution of Glucose does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII). If the solution of Glucose is not colorless, comparison must be made with 10 mils of the same solution, to which a volume of distilled water, equal to that of the hydrogen sulphide T.S., has been added.

Arsenic.—Dissolve 1.5 Gm. of Glucose in 5 mils of distilled water; add 5 mils of diluted sulphuric acid and 1 mil of bromine water and heat for five minutes on a water bath. Then add 0.5 Gm. of potassium iodide, follow it with 5 drops of stannous chloride T.S., cool and subject the solution to the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII). The stain produced, if any, is not greater than that produced in a test made with the same quantities of the reagents to which 2 mils of the standard arsenic test solution (see U. S. P., Test No. 1, Chapter LXII) has been added.

U. S. P. Preparations.—Extractum Belladonnæ Foliorum (Pilular); Extractum Cannabis; Extractum Hyoscyami; Extractum Stramonii (Pilular).

N. F. Preparations.—Extractum Cinchonæ; Extractum Conii.

Uses.—It is used officially as a diluent in pilular extracts (see official preparations above) and commercially it has replaced glycerin in many pharmaceutical preparations.

SACCHARUM. U. S. Sugar

[**Sacch.**—SUCROSE CANE SUGAR]

Sucrose [$C_{12}H_{22}O_{11}=342.18$] obtained from cultivated varieties of *Saccharum officinarum* Linné (Fam. *Gramineæ*), and from *Beta vulgaris* Linné, var. *Rapa* Dumort (Fam. *Chenopodiaceæ*) and from other sources.

Preparation.—Sugar is prepared commercially from the sugar cane, beet root, and sorghum. Formerly, sugar cane was the only source; but at present the root of *Beta vulgaris* is largely used in Europe, and to an increasing degree in this country, for making cane sugar, and from the rapid growth of this industry there is a prospect of its supplanting all others. To prepare sugar, the sugar cane is crushed, and the juice, amounting to about 80 per cent., is expressed; this is then heated, a little lime and calcium bisulphite added, strained, and the liquid quickly evaporated, cooled, and stirred. The thick liquid is transferred to cask perforated at the bottom, and the crystals drained. Sugar made in this way is called " open pan " sugar. It is now almost completely displaced by " vacuum pan " sugar.

In the production of raw sugars by the vacuum pan process, the juice, after " defecation " with lime and removal of excess of lime by carbonic acid gas, is run through large filters of bone black, and then into the vacuum pan for concentration. The vacuum pan is a large evaporating pan, closed above by a dome-like top, which connects with an exhausting steam pump, so that the liquid can be concentrated under very reduced pressure. The heat is supplied by coils of steam pipes which run through the interior of the pan. The saccharine juice is evaporated in this until it begins to crystallize, and even after this fresh portions are added, so that the crystals already formed grow by accretion of fresh material. After the crystallization is complete, the warm mixture of crystals and syrup is run into " centrifugals," to which a rapid revolution is given, and the crystals thus drained and dried.

Beet root sugar is made in a similar manner, but is more troublesome to purify than that made from sugar cane. The best sugar for pharmaceutical uses is known technically as " granulated." A sugar of very high purity, obtained by crystallizing the first runnings from the charcoal filters, is now largely used in preparing pharmaceutical syrups. It is sold under various trade names such as " *Druggists' Dry Granular* " and " *Crystal A*," and produces a syrup which is practically free from yellow tint. It is largely used to-day in making the so-called "rock candy syrup," in syrup percolators (see pages 317 and 319). Loaf-sugar is generally pure, but if kept in a damp atmosphere, it is liable to absorb moisture, and if kept in a very dry air, it will lose weight. For making troches, *lozenge sugar*, a very pure, finely powdered sugar, may be had through dealers in confectioners' supplies. "*Pulverized*" *sugar*, as it is called, is unfitted for such a purpose.

When sugar is crystallized in regular large monoclinic prisms, it is called *rock-candy*, and has the specific gravity 1.606. The official test excludes sugar which contains ultramarine; this was often added by refiners to save the expense of using bone-black, but is rarely used to-day. A sugar which is not entirely free from yellow color can be blued by ultramarine, and the fault thus covered up, so that most consumers remain ignorant of the deception; when solution is attempted, however, it is discovered, for the syrup is never colorless, and a sediment is deposited. This practice, however, has been almost entirely discontinued. Sugar in dilute aqueous solution is converted into alcohol, carbon dioxide, and eventually acetic acid, if exposed to warm air.

Cane sugar may be distinguished from grape sugar by Trommer's test, which consists in the use of copper sulphate and caustic potash. If a solution of cane sugar is mixed with a solution of copper sulphate, and potassium hydroxide added in excess, a deep blue liquid is obtained, which on being heated deposits, after a time, a little red powder. A solution of grape sugar, similarly treated, yields, by heat, a copious greenish precipitate, which rapidly changes to scarlet, and eventually to dark red. When heated to 185° C. (365° F.), cane sugar melts into a viscid, colorless liquid, which on being suddenly cooled forms a transparent amorphous mass, called *barley sugar*. At a higher temperature, between 204.4° and 215.5° C. (400° and 420° F.), it loses two molecules of water, and is converted into a very thick, black liquid, called *caramel*, which is used largely for coloring aqueous or hydro-alcoholic liquids and is now official in the N. F. (see page 1047). At a still higher heat it yields combustible gases, carbonic acid, empyreumatic oil, and acetic acid, and there remains one-fourth of its weight of charcoal, which burns without residue.

The valuation of sugars and syrups is now easily made through the use of the polariscope. A clear solution of sugar (26 Gm. in 100 mils) is poured into a tube of definite length; this is placed in the instrument and a ray of polarized light caused to pass through it from end to end; if the sugar is dextrogyre or dextrorotatory, it deviates the plane of polarization to the right; if lævogyre or lævorotatory, to the left; the extent of the deviation is read off from the circular scale on the polariscope, and the table of percentages gives at once the amount of pure sugar in the sample.

Official Description.—It occurs in white, hard, dry crystals or as a white, crystalline powder. It is permanent in the air.

Odor, Taste, and Reaction.—Odorless, and having a sweet taste. Its aqueous solution (1 in 20), is neutral to litmus and is dextrorotatory.

Solubility.—One Gm. of Sugar dissolves in 0.5 mil of water and in 170 mils of alcohol at 25° C. (77° F.); also in slightly over 0.2 mil of boiling water; insoluble in chloroform or ether.

Tests for Identity.—The specific rotation $[\alpha]_D$ of Sugar, determined at 20° C. (68° F.), in solution in distilled water, containing in 100 mils the equivalent of 26 Gm. of

Sugar, previously dried to a constant weight at 105° C. (221° F.), and using a 200 mm. tube, is not less than +65.9° (see U. S. P., Test No. 21, Chapter LXII).

Its aqueous solution saturated at 25° C. (77° F.) has a specific gravity of about 1.340.

Impurities and Tests for Impurities.—Incinerate about 2 Gm. of Sugar; not more than 0.05 per cent. of ash remains.

An aqueous solution of Sugar (2 in 1) is colorless when viewed horizontally through a vertical cylinder of colorless glass having an inside diameter of about 25 mm.

Insoluble Salts, Ultramarine, Prussian-blue.—When kept in large, well-closed, and completely filled bottles, the solution deposits no sediment on prolonged standing.

Calcium.—Ten mil portions of an aqueous solution of Sugar (1 in 10) tested separately give no precipitate with an equal volume of hydrogen sulphide T.S., and not more than a faint opalescence with a few drops of ammonium oxalate T.S.,

Sulphate.—barium nitrate T.S.

Chloride.—and silver nitrate T.S.

Invert Sugar.—Dissolve 20 Gm. of Sugar in enough distilled water to make 100 mils and filter the solution if necessary. To 50 mils of the clear liquid, contained in a 250 mil beaker, add 50 mils of alkaline cupric tartrate V.S., heat the mixture at such a rate that approximately four minutes are required to bring it to the boiling point, and then boil it for exactly two minutes. Add 100 mils of cold, recently boiled distilled water, and collect and weigh the precipitated cuprous oxide in the following manner:

Prepare a Gooch crucible with an asbestos layer. Thoroughly wash the asbestos with distilled water, followed successively by 10 mils of alcohol and 10 mils of ether; dry it at 100° C. (212° F). for thirty minutes and then weigh the prepared crucible. Collect the precipitated cuprous oxide on the asbestos, thoroughly wash it with hot distilled water, then with 10 mils of alcohol, and finally with 10 mils of ether and dry it at 100° C. (212° F). The weight of the cuprous oxide does not exceed 0.155 Gm., corresponding to not more than 0.5 per cent. of invert sugar.

U. S. P. Preparations.—Used in preparing syrups and also in Emulsum Amygdalæ; Ferri Carbonatis Saccharatus; Massa Ferri Carbonatis; Mistura Cretæ (from Compound Chalk Powder); Pilulæ Ferri Carbonatis; Pilulæ Ferri Iodidi; Pulvis Cretæ Compositus; Pulvis Glycyrrhizæ Compositus; Syrupus; Trochisci Acidi Tannici; Trochisci Ammonii Chloridi; Trochisci Potassii Chloratis; Trochisci Sodii Bicarbonatis.

N. F. Preparations.—Acetum Opii; Confectio Rosæ; Confectio Sennæ; Ferri Oxidum Saccharatum; Troches.

Uses.—Sugar is used principally in pharmacy for making syrups, troches, masses, confections, etc., as already noted.

Saccharures are preparations made by saturating sugar with tinctures, drying it, and then reducing the mixture to a fine powder.

Oleo-saccharures (Elæosacchara) are similar preparations made by incorporating one drop of a volatile oil with thirty grains of sugar. They form convenient modes of administering remedies to children.

Aromatic sugars may be prepared by pouring an alcoholic tincture of the spice drugs—cinnamon, cloves, etc.—over granulated sugar, and drying the product by exposing it to the air.

MEL. U. S. Honey

A saccharine secretion deposited in the honey-comb by the bee, *Apis mellifera* Linné (Fam. *Apidœ*).

It is not known whether honey is secreted by the bee, or whether it exists ready formed in plants. The nectaries of flowers contain a sweet substance, which is extracted by the insect. Large quantities of honey are obtained from California, the Southern States, and the West Indies. Before the passage of the Food and Drugs Act, large amounts of artificial honey were manufactured from glucose by flavoring and coloring, but the rigid enforcement of this law has practically eliminated the spurious article from the market.

Official Description.—A thick, syrupy liquid of a light yellowish or yellowish-brown color, translucent when fresh, but gradually becoming opaque and crystalline.

Odor, Taste, and Reaction.—A characteristic odor, and a sweet, faintly acrid taste. It is slightly acid to litmus.

Specific Gravity.—Dilute Honey with twice its weight of water; the resulting liquid is only moderately turbid, not stringy, and has a specific gravity of not less than 1.099 at 25° C. (77° F.) (corresponding to a specific gravity of not less than 1.370 for the original Honey).

Tests for Identity.—It is lævorotatory.

Impurities and Tests for Impurities.—Incinerate about 1 Gm. of Honey, accurately weighed, in a platinum crucible, in small portions at a time; not more than 0.3 per cent. of ash remains.

Chlorides.—Separate portions of 5 mils each of a filtered aqueous solution of Honey (1 in 5) acidified with nitric acid, are not rendered more than slightly opalescent by the addition of a few drops of silver nitrate T.S.,

Sulphates.—nor more than slightly cloudy by a few drops of barium chloride T.S.

Starch or Dextrins.—Boil about 2 Gm. of Honey with 10 mils of distilled water; the resulting solution, when cold, is not rendered blue, green or reddish on the addition of iodine T.S.

Foreign Coloring Matter.—The color of an aqueous solution of Honey (1 in 2) is not changed at once when mixed with an equal volume of ammonia water.

Azo Dyes.—5 mils of an aqueous solution of Honey (1 in 2) does not at once acquire a red or rose color on the addition of a few drops of hydrochloric acid.

A solution of 10 Gm. of Honey in 50 mils of distilled water requires not more than 0.5 mil of normal potassium hydroxide V.S. for neutralization, phenolphthalein T.S. being used as indicator.

Artificial or Added Invert Sugar.—Triturate about 1 Gm. of Honey with 20 mils of ether in a mortar, filter it into a porcelain dish or crucible, allow the filtrate to evaporate and add to the residue one drop of resorcinol T.S. At most only a pink color may be produced, which disappears in half a minute, but not an orange, cherry, or brown-red color.

U. S. P. Preparation.—Mel Depuratum.

Uses.—Honey is used pharmaceutically in the class Mellita (page 350), and as a vehicle and excipient. Owing to the difficulty of obtaining pure honey in large cities and towns, its place in many preparations has been filled by using syrup, glucose, or glycerin. Purified honey is official as Mel Depuratum (see page 351).

MANNA. U. S. Manna

The dried saccharine exudation of *Fraxinus Ornus* Linné (Fam. *Oleaceæ*).

Official Description.—In irregular, more or less elongated, flattened, 3-sided pieces; externally yellowish-white; friable, somewhat waxy; internally nearly white, porous and crystalline in appearance. Manna also occurs in irregular masses, consisting in part of brittle or soft, resin-like fragments; from yellowish-white to yellow-gray in color. The quantity of the yellowish-white fragments must not be less than 40 per cent. of the whole.

Odor and Taste.—Odor slight, characteristic: taste sweet, slightly bitter and faintly acrid.

Tests for Identity.—Add 5 Gm. of Manna to 100 mils of alcohol, heat to boiling and filter; on cooling, the filtrate rapidly deposits crystals of mannite.

U. S. P. Preparation.—Infusum Sennæ Compositum.
N. F. Preparation.—Syrupus Mannæ.

This substance, which is found in commerce of varying quality, is, when pure, soluble in three parts of cold water and in its own weight of boiling water. It separates in crystalline masses from a boiling, saturated, aqueous solution. It is soluble in alcohol; boiling alcohol will often dissolve fifteen per cent. of it, and upon cooling deposit beautiful crystals of mannite.

The principal constituent of manna is *mannite,* a peculiar, sweet principle, which is also found in many other plants.

Mannite is white, inodorous, crystallizable in semi-transparent needles, of a sweetish taste, soluble in five parts of cold water, scarcely soluble in cold alcohol, but readily dissolved by that liquid when hot, and deposited when it cools. Its composition is $C_6H_{14}O_6$, and it is considered as belonging to the class of *hexatomic alcohols.* It may be obtained by boiling manna in alcohol, allowing the solution to cool, and redissolving the crystalline precipitate. Pure mannite is then deposited. Mannite is found in many plants, and may be converted by oxidation into mannose, a fermentable sugar.

Uses.—Manna is used as a laxative, and often added to senna leaves to make a cathartic infusion. The dose is from one-half to two ounces (15.5 to 62 Gm.).

GLYCYRRHIZA. U. S. Glycyrrhiza

[**Glycyrrh.**—LICORICE LIQUORICE ROOT]

The dried rhizome and roots of *Glycyrrhiza glabra typica* Regel et Herder, known in commerce as Spanish Licorice, or of *Glycyrrhiza glabra glandulifera* Regel et Herder, known in commerce as Russian Licorice (Fam. *Leguminosæ*).

Preserve powdered and whole Glycyrrhiza in tightly-closed containers to which a few drops of chloroform or carbon tetrachloride are added from time to time to prevent attack by insects.

Spanish Licorice.—Official Description.—(Also known as Italian, Levant, Persian, Turkish, or Arabian Licorice).—Nearly cylindrical, upper portion more or less knotty; usually in pieces from 14 to 20 cm. or more in length and from 5 to 20 mm. in thickness; externally yellowish-brown or dark brown, longitudinally wrinkled, the thinner rhizomes often having prominent alternate buds, the thicker rhizomes having distinct corky patches; fracture coarsely fibrous; internally lemon-yellow, radiate; bark from 1 to 3 mm. in thickness; wood porous, in narrow wedges, rhizome with small pith.

Odor and Taste.—Odor distinctive; taste sweetish and slightly acrid.

Tests for Identity and Purity.—Under the microscope, transverse sections of pieces of the older rhizome of Spanish Licorice show a periderm of numerous layers of yellowish-brown cork cells, a phellogen and one or more rows of cells of the phelloderm, the cells showing a tendency to collenchymatous thickenings and with occasional monoclinic prisms of calcium oxalate; a middle bark of starch-bearing parenchyma and whitish groups of bast-fibers surrounded with crystal-fibers; inner bark with a very characteristic radial arrangement of phloem and medullary rays, the phloem consisting of wedges of small groups of bast-fibers and parenchyma, separated by an almost continuous, obliterated sieve tissue, the cells of the latter being very irregular in outline and with thick, highly refracting walls; medullary rays from 1 to 8 cells wide; wood characterized by broad wedges consisting of large tracheæ with yellowish walls, small compact groups of wood-fibers and starch-bearing parenchyma alternating with the broad medullary rays; pith composed of parenchyma, the cells being large, more or less polygonal in outline and containing numerous starch grains, or prisms of calcium oxalate. In sections of roots the pith is absent.

Russian Licorice.—Official Description.—Nearly cylindrical, somewhat tapering, sometimes split longitudinally, from 15 to 30 cm. in length and from 1 to 5 cm. in diameter; when deprived of the outer corky layer, it is externally pale-yellow; fracture coarsely fibrous; internally lemon-yellow; wood radially cleft.

Odor and Taste.—Odor distinct; taste sweetish.

Tests for Identity and Purity.—Under the microscope, transverse sections of the rhizome and roots of Russian Licorice somewhat resemble those of Spanish Licorice, but the cork cells are absent.

Powdered Glycyrrhiza is pale brownish-yellow (Spanish Licorice) or pale yellow (Russian Licorice); starch grains numerous, mostly single and elliptical or oval, and from 0.002 to 0.02 mm. in diameter; tracheæ mostly with bordered pores; wood- and bast-fibers numerous, strongly lignified, very long, much attenuated at the ends and about 0.01 mm. in width; crystal-fibers with monoclinic prisms of calcium oxalate, the latter from 0.01 to 0.02 mm. in diameter; occasional fragments of reddish-brown cork cells occur in Spanish Licorice, but are practically absent in the Russian Licorice.

Add 10 Gm. of powdered Glycyrrhiza to 100 mils of distilled water, allow the mixture to macerate for fifteen minutes with occasional stirring; and then heat it for one-half hour on a water bath. Filter the mixture and add through the filter enough water to make the filtrate measure 100 mils; not less than 0.2 Gm. of residue remains on evaporating 10 mils of this filtrate and drying it at 100° C. (212° F.).

Glycyrrhiza yields not more than 7 per cent. of ash.

U. S. P. Preparations.—Extractum Glycyrrhizæ; Extractum Glycyrrhizæ Purum; Fluidextractum Glycyrrhizæ; Fluidextractum Sarsaparillæ Compositum; Massa Hydrargyri; Mistura Glycyrrhizæ Composita (from Extract); Pilulæ Ferri Iodidi; Pulvis Glycyrrhizæ Compositus; Syrupus Sarsaparillæ Compositus (from Fluidextract); Tinctura Aloes; Trochisci Ammonii Chloridi; Trochisci Cubebæ.

N. F. Preparations.—Decoctum Sarsaparillæ Compositum; Elixir Glycyrrhizæ Aquosum (from Fluidextract); Elixir Glycyrrhizæ Aromaticum (from Fluidextract); Elixir Taraxaci Compositum (from Fluidextract); Fluidglyceratum Cascaræ Sagradæ Aromaticum; Fluidglyceratum Glycyrrhizæ; Mistura Ammonii Chloridi (from Pure Extract); Mistura Olei Picis; Pilulæ Ad Prandium (Hall's) (from Extract); Species Pectorales; Syrupus Cimicifugæ Compositus (from Fluidextract); Syrupus Glycyrrhizæ (from Fluidglycerate); Tinctura Aloes et Myrrhæ; Tinctura Rhei Dulcis.

This well-known root contains the sweet principle *glycyrrhizin,* or *glycyrrhizic acid,* $C_{44}H_{63}O_{18}N$. This was found by Roussin to exist in the root in combination with ammonia. There is also present an oleoresinous substance which communicates to the root a slight acridity. If alcohol is used as a menstruum for the root and the preparation not treated to deprive it of acridity, it will have a disagreeable after-taste.

Uses.—Glycyrrhiza is valuable in pharmacy solely on account of the sweet principle. It is one of the most efficient substances known for masking the taste of bitter substances, like quinine sulphate. It is used in a number of official preparations (see above).

Average dose.—30 grains (2 Gm.)

GLYCYRRHIZINUM AMMONIATUM. U. S. Ammoniated Glycyrrhizin

[Glycyrrh. Ammon.]

A sweet principle, combined with ammonia, obtained from glycyrrhiza.

Preparation.—The U. S. P. IX did not introduce a manufacturing process but, that of the U. S. P. VIII is as follows: Glycyrrhiza, in No. 20 powder, 500 Gm. [old form 25 oz. av.], water, ammonia water, sulphuric acid, each, a sufficient quantity. Mix 475 mils [old form 23 fl. oz.] of water with 25 mils [old form 1 fl. oz. and 1 fl. dr.] of ammonia water, and, having moistened the powder with the mixture, macerate for twenty-four hours. Then pack it moderately in a conical glass percolator, and gradually pour water upon it until 500 mils [old form 24 fl. oz.] of percolate are obtained. Add sulphuric acid slowly to the percolate, with constant stirring, so long as a precipitate is produced. Collect this on a strainer, wash it with cold water until the washings no longer have an acid reaction, redissolve it in water with the aid of ammonia water, filter, if necessary, and again add sulphuric acid so long as a precipitate is produced. Collect this, wash it, dissolve it in a sufficient quantity of ammonia water previously diluted with an equal volume of water, and spread the clear solution upon plates of glass, so that when dry, the product may be obtained in scales.

The introduction of this preparation is the result of the very important researches of Z. Roussin, who noticed that *glycyrrhizin*, the sweet principle of licorice root, was insipid when compared with the root itself, and inferred that it existed in a modified form in the root. Experiment showed that alkalies developed the sweet taste, and he ultimately proved that the alkali with which it was combined in the root was ammonia, and that glycyrrhizin played the part of an acid. Licorice root which has lost a portion of its sweetness through fermentation and the development of acetic acid and precipitation of insoluble glycyrrhizin can be restored to its former sweetness if allowed to remain a sufficient length of time in an ammoniacal atmosphere.

Official Description.—It occurs in dark brown or brownish-red scales.
Odor and Taste.—Without odor, and having a very sweet taste.
Solubility.—It is freely soluble in water and soluble in alcohol.
Tests for Identity.—Its aqueous solution when heated with potassium hydroxide T.S. evolves ammonia.

Supersaturate an aqueous solution of Ammoniated Glycyrrhizin with an acid; a precipitate is produced (consisting essentially of *glycyrrhizin*), which, when dissolved in hot water, forms a jelly on cooling. This substance, after being washed with diluted alcohol and dried, appears as an amorphous, yellow powder, having a strong, bitter-sweet taste, and an acid reaction.

Incinerate 0.5 Gm. of Ammoniated Glycyrrhizin; not more than 0.5 per cent. of ash remains.

Uses.—This compound is useful when mixed with bitter or disagreeable powders to mask their taste.

TRITICUM. U. S. Triticum

[Tritic.—Couch Grass Dog Grass]

The dried rhizome and roots of *Agropyron repens* (Linné) Beauvois (Fam. *Gramineæ*), gathered in the spring.

Official Description.—Usually in pieces from 4 to 12 mm. in length and from 1 to 2.5 mm. in diameter; externally light yellow or yellowish-brown, longitudinally furrowed, smooth, lustrous, nodes with circular leaf-scars, a few root-scars and occasional slender roots; fracture tough, fibrous; internally lemon-yellow and with a large, hollow pith; odor slight, aromatic; taste sweetish.

Roots filiform, irregularly branching, attaining a length of about 5 cm. and not more than 0.5 mm. in thickness, light brown or yellowish-brown, frequently covered with long root hairs.

Under the microscope, transverse sections of Triticum show a single layer of strongly lignified epidermal cells; a hypodermis of from 3 to 6 rows of more or less polygonal cells with strongly lignified walls; a cortex of from 10 to 16 rows of thin-walled parenchyma cells, occasionally with nearly spherical starch grains about 0.005 mm. in diameter, or with irregular masses of a more or less soluble carbohydrate; among the parenchyma cells and near the hypodermis occur small, widely separated fibro-vascular bundles, each with a closed sheath of sclerenchymatous fibers; an endodermis, the lateral and inner walls of the cells moderately thickened, strongly lignified and somewhat porous; several layers of sclerenchymatous fibers immediately inside the endodermal ring, in which are imbedded an interrupted circle of collateral fibro-vascular bundles having large tracheæ; adjoining these are usually 8 to 10 rows of parenchyma cells with a few fibro-vascular bundles and a pith in which the parenchyma cells are more or less broken or absent.

The powder is light yellowish; consisting of irregular, lignified fragments; numerous fragments showing tracheæ with annular or spiral thickenings or marked with simple pores and associated with long, narrow, rather thin-walled, strongly lignified sclerenchymatous fibers; fragments of epidermis made up of cells rectangular in outline, the longer walls considerably thickened, strongly lignified and marked with numerous transverse pores; ends of epidermal cells usually separated from each other by a very narrow cell with thin walls and few pores; numerous fragments of parenchyma rectangular in outline and with thin, porous walls.

Triticum yields not more than 3 per cent. of ash.

U. S. P. Preparation.—Fluidextractum Tritici.

Triticum is usually found in the market cut into small sections. It contains *triticin*, a principle resembling inulin, also glucose, levulose, etc.

Uses.—It is used as a diuretic and for special action on the urinary organs in the dose of one hundred and twenty grains (8 Gm.).

CARAMEL. N. F. Caramel

[**Caram.**—Saccharum Ustum Burnt Sugar Coloring]

A concentrated aqueous solution of the product obtained by heating sugar or glucose until the sweet taste is destroyed and a uniform dark-brown mass results, a small amount of alkali or alkali carbonate being added while heating (see page 1041).

Official Description.—Caramel is a thick, dark-brown liquid and mixes clear with water in all proportions; 1 part dissolves in 1000 parts of distilled water yielding a clear solution, having a distinct sepia tint. The color of this solution is not changed and no precipitate is formed after exposure to sunlight for six hours.

Odor and Taste.—It has the characteristic odor of burnt sugar and a pleasant, bitter taste.

Solubility.—It is soluble in diluted alcohol, but is precipitated when the alcoholic content of the solution is increased to 80 per cent., by volume, or more. It is insoluble in ether, chloroform, acetone, benzene, petroleum benzin, or oil of turpentine.

Specific Gravity.—Not less than 1.35 at 25° C. (77° F.).

Tests for Identity and Purity.—Spread a thin layer of Caramel on a glass plate; it appears homogeneous, reddish-brown and transparent.

No precipitate is produced in 20 mils of an aqueous solution of Caramel (1 in 20) on the addition of 0.5 mil of phosphoric acid.

Caramel swells when incinerated and forms a coke-like charcoal, which burns off only after prolonged heating at a high temperature, and yields not more than 8 per cent. of ash.

N. F. Preparations.—Elixir Ammonii Valeratis (from Compound Tincture of Persionis); Elixir Cinchonæ Alkaloidorum (from Compound Tincture of Persionis); Elixir Pepsini et Bismuthi (from Tincture); Elixir Quininæ Valeratis et Strychninæ (from Compound Tincture of Persionis); Elixir Strychninæ Valeratis (from Compound Tincture of Persionis); Elixir Vanillini Compositum; Syrupus Bromidorum (from Compound Tincture); Tinctura Caramellis; Tinctura Pectoralis; Tinctura Persionis Composita.

Uses.—It is used to produce a brown color in elixirs, syrups, etc.

QUESTIONS ON SUGARS AND SACCHARINE SUBSTANCES

What are sugars? (See page 1037.)
To what is the term sugar popularly applied?
Into what classes may sugars be divided?
Into what two sub-classes may they be conveniently divided?
Name the more important sugars belonging to each class.
Glucose—What are its synonyms? What is its formula in symbols?
How is it obtained on the large scale?
To what is the term "grape sugar" applied?
Is glucose more or less sweet than cane-sugar?
How does its solubility compare with cane sugar?
What is its specific gravity when anhydrous?
Wherein does the action of strong mineral acids and of alkalies upon glucose differ from their action upon cane sugar?
In what direction does its solution rotate the plane of polarization of polarized light?
Is it capable of direct fermentation?
What effect has it in boiling solution upon alkaline cupric tartrate?
Describe its appearance, odor, taste, reaction, and solubility.
Give tests for identity.

What impurities are likely to be present and how detected?
What are its official uses?
Sugar—What is the Latin name?
Give the synonyms.
Give its formula in symbols.
How is it prepared commercially?
What is the difference between the "open pan process" and the "vacuum process"?
What is the best sugar for pharmaceutical purposes?
What is "Druggists' dry granular sugar"; "crystal A sugar"; "lozenge sugar"; "pulverized sugar"; "rock candy"?
Why was ultramarine formerly added to sugar?
What is Trommer's test to distinguish the difference between cane sugar and grape sugar?
How is the polariscope used to determine the value of sugar and sugar solutions?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Insoluble salts, ultramarine, Prussian blue, etc.; calcium; sulphate; chloride; invert sugar.
What change takes place when sugar in dilute solution is exposed to warm air?
When cane sugar is heated to 185° C. (365° F.), what change takes place, and what is formed?
At a higher temperature, 204.4° to 215.5° C. (400° to 420° F.), what change takes place?
At a still higher temperature what occurs?
For what purposes in pharmacy is sugar used?
What are saccharures?
What are oleo-saccharures (elæosacchara)?
What is aromatic sugar and how is it made?
Honey—Whence is it obtained?
Describe appearance, odor, taste, chemical reaction, and solubility. What is its specific gravity?
How may the following impurities be detected?—Chlorides; sulphates; starch or dextrines; foreign coloring; added invert sugar.
For what is honey used in pharmacy?
In what form is it official?
What is manna? Describe its appearance, odor and taste. Give a test for identity.
What is its solubility in water? In alcohol?
What is the principal constituent of manna?
What are the physical properties of mannite?
What is its chemical composition, and to what class is it considered to belong?
How may it be obtained?
For what is manna used, and what is the dose?
Glycyrrhiza—What is the Latin official name? What are the synonyms? Whence obtained?
Describe Spanish licorice.
Describe Russian licorice.
What sweet principle does glycyrrhiza contain?
What is its chemical composition, and in what combination does it exist in the root?
To what does the root owe its acridity?
What are the official preparations of glycyrrhiza?
Ammoniated glycyrrhizin—What is the Latin official name?
How is it made?
What effect do alkalies have upon glycyrrhizin?
For what is this compound useful?
What is triticum, and how is it found in commerce? Give the synonyms.
What principles does triticum contain?
For what is it used?
What official preparation of triticum is there?
Caramel—Give the Latin title and synonyms.
How is it prepared? Describe its appearance, odor, taste, and solubility.
What is its specific gravity? Give tests for identity and purity.
What are its pharmaceutical uses?

CHAPTER LII

DERIVATIVES OF SUGARS THROUGH THE ACTION OF FERMENTS

Fermentation.—When certain organic bodies are subjected to the action of water, air, and a warm temperature, decomposition takes place. This is accompanied by the presence of microscopic organisms, and the result is the formation of new products. When decomposition is followed by the production of worthless or offensive substances, it is termed *putrefaction*; when useful products are formed, the process if called *fermentation.*

Two prominent theories accounting for the phenomena of fermentation have been advanced—one, in which the action is regarded as a chemical process, the presence of the microscopic bodies being considered unimportant; the other (which is now universally accepted) that fermentation is caused by the presence of the organisms.

Ferments may be divided into two classes: 1. Organized or physiological ferments, which may be subdivided into three classes—(*a*) mould growths, represented by *Penicillium glaucum*; (*b*) yeast plants, or saccharomyces, this is now official in the N. F. (see page 1050); (*c*) bacteria, constituting a very numerous class. 2. Unorganized or soluble nitrogenous ferments, like diastase, synaptase, myrosin, invertin, emulsin, pepsin, pancreatin, etc. Fermentation which is produced by the latter class has been termed *false fermentation*, and the ferments themselves called *cryptolytes.*

Vinous Fermentation.—Cane sugar, as before stated, is capable of being decomposed by this process and converted into alcohol and carbon dioxide, but it will not undergo the vinous fermentation by itself. It requires to be dissolved in water, subjected to the influence of a ferment, and kept at certain temperatures, 18° to 35° C. (64.4° to 95° F.). Accordingly, sugar, water, the presence of a ferment, and the maintenance of an adequate temperature must be deemed the prerequisites of the vinous fermentation. The water acts by giving fluidity, and the ferment and temperature by commencing and maintaining the chemical changes. The precise manner in which the ferment operates has not been positively determined.

Beginning with the simple substances, cellulose and starch, it will be found that, through the action of dilute acids and ferments, they may be converted into alcohol or acetic acid:

$$\underset{\text{Cellulose or Starch}}{(C_6H_{10}O_5)_3} + \underset{\text{Water}}{H_2O} = \underset{\text{Maltose}}{C_{12}H_{22}O_{11}} + \underset{\text{Starch}}{C_6H_{10}O_5}$$

then

$$\underset{\text{Maltose}}{C_{12}H_{22}O_{11}} + \underset{\text{Starch}}{C_6H_{10}O_5} + \underset{\text{Water}}{2H_2O} = \underset{\text{Glucose}}{(C_6H_{12}O_6)_3}$$

then

$$\underset{\text{Glucose}}{C_6H_{12}O_6} = \underset{\text{Alcohol}}{(C_2H_5OH)_2} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{2CO_2}$$

And if the action is not arrested, the acetous fermentation begins, resulting in the conversion of the alcohol into acetic acid through oxidation:

$$\underset{\text{Alcohol}}{C_2H_5.OH} + \underset{\text{Oxygen}}{O_2} = \underset{\text{Acetic Acid}}{C_2H_4O_2} + \underset{\text{Water}}{H_2O}$$

The most important derivative of sugar through the action of a ferment is alcohol. This is usually obtained from whisky by distillation. The distilled product of vinous liquors forms the different ardent spirits of commerce. When obtained from wine, it is called *brandy*; from fermented molasses, *rum*; from cider,[1] malted barley, or rye, *whisky*; from malted barley and rye-meal, with hops, and rectified from juniper berries, *Holland gin*; from malted barley, rye, or potatoes, and rectified from turpentine, *common gin*; and from fermented rice, *arrack*. These spirits are of different strengths—that is, contain different proportions of alcohol—and have various peculiarities by which they are distinguished by the taste.

The compounds derived from sugars will be considered under the following sub-heads: 1. Ethyl hydroxide and oxide and their preparations. 2. Preparation of the esters of the ethyl, methyl, and amyl series. 3. Aldehyde, its derivatives and preparations.

Yeast is official in the N. F. for the making of fermented milk (see Chapter LXI). It is described as follows:

CEREVISIÆ FERMENTUM COMPRESSUM. N. F. Compressed Yeast [Cerev. Ferm. Compr.]

The moist, living cells of *Saccharomyces cerevisiæ* Meyen (Fam. *Saccharomycetaceæ*) or of other species of *Saccharomyces*, combined with a starchy or absorbent base.

Official Description.—White or yellowish-white, soft and easily broken masses, having a characteristic, slightly sour odor, and not more than a faintly acid reaction to litmus.

When examined under the microscope, numerous oidium and mycoderma cells and starch grains are visible.

Compressed yeast must not be used unless fresh, and free from mildew and musty or foul odors.

N. F. Preparation.—Lac Fermentatum.

Ethyl Hydroxide and Oxide and Their Preparations

The compounds containing the radical *ethyl* are the most important of those derived from organic substances, alcohol being the source of all.

Alcohol is regarded chemically as the type of a class of carbon compounds called alcohols, of which there are many important members. *They are hydroxides of the alcohol radicals* (ethyl hydroxide, ethyl alcohol; amyl hydroxide, amyl alcohol), just as slaked lime, or calcium hydroxide, is the hydroxide of the metal calcium.

Ethers are the *oxides of these radicals*, just as lime, or calcium oxide, is the oxide of the metal calcium.

Esters, formerly called *compound ethers*, are analogous to the salts of the metals, being formed by the decomposition of their alcohols by acids—*i.e.*, ethyl nitrite, ethyl acetate, amyl nitrite—just as potassium nitrate, sodium acetate, and calcium sulphate may be produced by decomposing the hydroxides of their respective metals with acids. In each case water is formed as one of the results of the decomposition. This may be shown by the reactions:

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[1] The name whisky is properly applied only to the distilled product obtained from rye, wheat, barley, corn, or other grain. See *Spiritus Frumenti*, see page 1051.

$$\underset{\substack{\text{Sodium}\\\text{Hydroxide}}}{NaOH} + \underset{\substack{\text{Acetic}\\\text{Acid}}}{C_2H_4O_2} = \underset{\substack{\text{Sodium}\\\text{Acetate}}}{NaC_2H_3O_2} + \underset{\text{Water}}{H_2O}$$

$$\underset{\substack{\text{Alcohol or}\\\text{Ethyl Hydroxide}}}{C_2H_5.OH} + \underset{\substack{\text{Acetic}\\\text{Acid}}}{C_2H_4O_2} = \underset{\text{Ethyl Acetate}}{C_2H_5C_2H_3O_2} + \underset{\text{Water}}{H_2O}$$

Whisky was not admitted to the U. S. P. IX or to the N. F. IV, but the U. S. P. VIII text is given below:

SPIRITUS FRUMENTI. U. S. Whisky

An alcoholic liquid obtained by the distillation of the fermented mash of grain—such as Indian corn, rye, wheat, and barley, or their mixtures.

Preparation.—Owing to the immense production of grain in this country, the cheapest sources of starch (corn, wheat, and rye) are used in making alcoholic liquids. The operations by which whisky is obtained from grain are technically termed—1. *Mashing*, by which the starch is converted into sugar. 2. *Fermentation*, or the production of the alcohol. 3. *Distillation*, or the separation of the crude spirit.

The crushed grain, mixed with malt, is added to water at 15.56° C. (60° F.), and allowed to stand, to permit the conversion of the starch into maltose, through the action of the diastase. The liquid is now termed the *wort*. This is caused to ferment by the addition of yeast, and alcohol is gradually formed, carbon dioxide escaping. The liquor is then distilled, the distillate being termed *low wines*. This is again distilled, and *raw whisky* is the product. This, upon keeping, especially in a warm room, improves in quality through the formation of esters, which are supposed to communicate an agreeable flavor to the liquid.

Official Description.—An amber-colored liquid. Whisky should be at least four years old.

Odor, Taste and Reaction.—Distinctive odor and taste, and a slightly acid reaction.

Specific Gravity.—Not more than 0.945, nor less than 0.924 at 15.56° C. (60° F.), corresponding, approximately, to an alcoholic strength of 37 to 47.5 per cent. by weight, or 44 to 45 per cent. by volume, of absolute alcohol (see Alcohol Tables, page 1056).

Impurities and Tests for Impurities.—If 50 mils of Whisky be shaken vigorously in a stoppered flask with 25 Gm. of kaolin, and, after standing half an hour, be filtered, the color of the filtrate should not be much lighter than that of the Whisky before treatment.

Not more than a trace of Fusel Oil from Grain. If 100 mils of Whisky be very slowly evaporated in a tared dish on a water-bath, the last portions volatilized should not have a harsh or disagreeable odor.

Added Sugar, Glycerin, and Aromatic Substances. The residue when dried at 100° C. (212° F.), should not weigh more than 0.5 Gm. This residue should have no sweet or distinctly spicy taste.

More than traces of Oak Tannin from Casks. The above residue should almost completely dissolve in 10 mils of cold water, forming a solution which is colored not deeper than light green by a few drops of ferric chloride T.S. diluted with 10 volumes of water.

Limit of Free Acid. To render 100 mils of Whisky distinctly alkaline to litmus, not more than 1.2 mils of normal potassium hydroxide V.S. should be required.

Uses.—Crude or "raw" whisky is the source of alcohol which is largely used in the industries and arts. It is also used as a fuel (see pages 119 and 1053). When purified and mellowed by age, whisky is used as a stimulant.

ALCOHOL. U. S. Alcohol

A liquid containing not less than 92.3 per cent. by weight or 94.9 per cent. by volume, at 15.56° C. (60° F.), of $C_2H_5.OH$ (46.05). Preserve it in well-closed containers, in a cool place, remote from fire.

ALCOHOL DEHYDRATUM. U. S. Dehydrated Alcohol

[**Alcohol Dehyd.**—ALCOHOL ABSOLUTUM, U. S. P. VIII]

A liquid containing not less than 99 per cent. by weight of $C_2H_5.OH$ (46.05). Preserve it in well-closed containers, in a cool place, remote from fire.

Preparation.—The natural sources of alcohol are starch and sugar as they exist in various plants, and alcohol, if pure, is the same from whatever source it is derived. It is generally made by distilling whisky, and redistilling and rectifying the distillate in an apparatus termed an alcohol column and still. The yield of alcohol, sp. gr. 0.835, obtained from good whisky is about 58 per cent. by volume. The principal impurity is *fusel oil,* or amylic alcohol. Alcohol may be deprived of odor by treating it with potassium permanganate and redistilling. *Absolute alcohol* is the name given to the strongest alcohol which can be made, and which is intended to be absolutely free from water. This is a difficult preparation to make, owing to the very strong affinity existing between the two liquids. The strongest alcohol that can be made by simple distillation contains 11 per cent. of water. An alcohol of about 92 per cent. strength, by weight, may be obtained by the use of a column and still, but in order to free it from the last 5 to 8 per cent. of water it is necessary to use some substance having a still stronger affinity for water. This is found in recently burned lime, and the method employed is to percolate the strongest and purest alcohol attainable through the lime, out of contact with air, and then to redistil the percolate in vacuo. In this way alcohol may be obtained having a specific gravity as low as 0.79355 at 15.56° C. (60° F.). (Squibb.) The official description for dehydrated alcohol of not less than 99 per cent. strength, formerly known as absolute alcohol, is as follows:

Official Description.—It is a transparent, colorless, mobile, and volatile liquid. It is very hygroscopic.

Odor and Taste.—A characteristic odor, and a burning taste.

Specific Gravity.—Not above 0.798 at 15.56° C. (60° F.), the U. S. Government standard temperature for alcohol, nor above 0.790 at 25° C. (77° F.).

Tests for Identity and Purity.—*Water.*—Shake 10 mils of Dehydrated Alcohol in a stoppered tube with about 0.5 Gm. of powdered anhydrous copper sulphate; the latter does not become blue.

In other respects Dehydrated Alcohol has the properties and responds to the tests and reactions under *Alcohol.*

N. F. Preparation.—Liquor Phosphori.

Alcohol burns with a pale flame without residue, the products being carbon dioxide and water. Absolute alcohol consists of two atoms of carbon, six of hydrogen, and one of oxygen. Its empirical formula is, therefore, C_2H_6O. It is recognized as the hydroxide of the radical ethyl (C_2H_5), so that its structural formula would be $C_2H_5.OH$.

Alcohol is official in three forms: dehydrated alcohol, sp. gr. 0.798 at 15.56° C. (60° F.), 0.790 at 25° C. (77° F.); alcohol, sp. gr. 0.816

at 15.56° C. (60° F.), 0.810 at 25° C. (77° F.); diluted alcohol, sp. gr. 0.935 to 0.937 at 15.56° C. (60° F.), 0.930 to 0.932 at 25° C. (77° F.). The temperature at which the specific gravity of alcohol is taken for official preparations is exceptional, the old temperature 15.56° C. (60° F.) being retained because the United States Internal Revenue Department uses this temperature for their standards.

Deodorized alcohol was official in the U. S. P. 1890, but owing to improved methods of purifying alcohol, the tests for its purity are in the U. S. P. IX applied to Alcohol, so that practically it may be said that the present official alcohol is the deodorized product. The description of alcohol, U. S. P. IX is as follows:

Official Description.—It is a transparent, colorless, mobile and volatile liquid.

Odor, Taste, and Reaction.—It has a slight, characteristic odor, and a burning taste. It does not affect the color of blue or red litmus paper previously moistened with water.

Miscibility.—It is miscible with water in all proportions, and without any trace of cloudiness; also miscible with ether or chloroform.

Specific Gravity.—Not above 0.816 at 15.56° C. (60° F.), the U. S. Government standard temperature for Alcohol, nor above 0.810 at 25° C. (77° F.).

Tests for Identity.—Alcohol is readily volatilized, even at low temperatures, and boils at about 78° C. (172.4° F.). It is inflammable, and burns with a pale blue, smokeless flame.

Evaporate 50 mils of Alcohol in a platinum or porcelain dish on a water bath; the residue does not exceed 0.002 Gm.

Impurities and Tests for Impurities.—*Fusel Oil Constituents.*—Mix 10 mils of Alcohol with 5 mils of distilled water and 1 mil of glycerin and allow the mixture to evaporate spontaneously from a piece of clean, odorless blotting paper; no foreign odor is perceptible when the last traces of the Alcohol leave the paper.

Amyl Alcohol or Non-volatile, Carbonizable Organic Impurities, etc.—Allow 25 mils of alcohol to evaporate spontaneously in a porcelain evaporating dish, carefully protected from dust, until the surface of the dish is barely moist. No red or brown color is produced upon the addition of a few drops of colorless sulphuric acid.

Aldehyde or Oak Tannin.—Mix 10 mils of Alcohol in a test tube with 5 mils of potassium hydroxide T.S.; the liquid does not at once assume a yellow color.

Organic Impurities, Amyl Alcohol, Aldehyde, etc.—Shake 20 mils of Alcohol in a clean, glass-stoppered bottle with 1 mil of silver nitrate T.S.; the mixture does not become more than faintly opalescent, or acquire more than a faint brownish tint when exposed for six hours to diffuse daylight.

Methyl Alcohol.—Dilute the Alcohol with distilled water until it contains about 10 per cent., by volume, of ethyl alcohol. Transfer 5 mils of the dilute alcohol to a test tube, add to it 2 mils of a potassium permanganate solution (made by dissolving 3 Gm. of potassium permanganate in 100 mils of distilled water) and 0.3 mil of sulphuric acid, and allow the mixture to stand for five minutes. Now dissolve the precipitate of manganese dioxide by the addition of sulphurous acid, drop by drop with agitation, then add 1 mil of sulphuric acid and 5 mils of fuchsin-sulphurous acid T.S. and mix them. After standing for ten minutes, a colorless liquid results.

Acetone.—A mixture of 5 mils of Alcohol, 2 mils of sodium hydroxide T.S., and 5 drops of a freshly made aqueous solution of sodium nitroprusside (1 in 50), rendered slightly acid with acetic acid, shows no violet tint within one minute.

U. S. P. Preparation.—Alcohol Dilutum.

Uses.—Alcohol is used in pharmacy principally for its solvent powers (see pages 213, 461). It is used as the source of many important compounds, like ether, chloroform, iodoform, etc., and as an antiseptic. The *cologne spirit* is generally a purified product, and cleaner than ordinary alcohol. A specially fine brand of alcohol can now be had which is rectified particularly for perfumers' use. It is said to be made by diluting the cologne spirit with sufficient water to bring it to about the strength of diluted alcohol, passing this through bone black, and then redistilling and concentrating it again to the proper strength in the rectifying column and still. Alcohol is also largely used as a fuel, chiefly in the form of denatured alcohol (see page 119).

ALCOHOL DILUTUM. U. S. Diluted Alcohol
[Alcohol Dil.]

A liquid containing from 41 to 42 per cent. by weight or from 48.4 to 49.5 per cent. by volume, at 15.56° C. (60° F.), of $C_2H_5.OH$ (46.05). Preserve it in well-closed containers, in a cool place, remote from fire.

	Metric	Old form
***Alcohol**	500 mils	1 pint
Distilled Water	500 mils	1 pint

Measure the alcohol and water at the same temperature and mix them.

If the two liquids are measured at the temperature of 25° C. (77° F.), the mixture, when cooled to the same temperature, will measure about 970 mils.

Diluted Alcohol may also be prepared in the following manner:

	Metric	Old form
***Alcohol**	408 Gm.	40 oz. av. 350 gr.
Distilled Water	500 Gm.	50 oz. av.

Mix them.

When alcohol and water are mixed together, a rise in temperature and a contraction in volume take place. In small operations the contraction is generally disregarded; in larger operations the loss is very apparent. If 55 gallons of alcohol are mixed with 45 gallons of water, the product will not be 100 gallons of diluted alcohol, but only 96¼ gallons, showing a loss of 3¾ gallons. United States *Proof Spirit* differs from diluted alcohol and is stronger; it contains 50 per cent. (or, more exactly, 49.5) *by weight of absolute alcohol.*[1]

Specific Gravity.—Diluted Alcohol has a specific gravity of from 0.935 to 0.937 at 15.56° C. (60° F.), the U. S. Government standard temperature for alcohol, and from 0.930 to 0.932 at 25° C. (77° F.).

Tests for Identity and Purity.—It responds to the reactions and tests under *Alcohol*, allowance being made for the difference in strength and the presence of water and the boiling point being omitted.[2]

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[1] If spirits have a specific gravity lighter than 0.920 (that of proof spirit) they are said to be *above proof;* if heavier, *below proof*, and the percentage of water or of alcohol, of the specific gravity of 0.825, necessary to be added to any sample of spirit to bring it to the standard of proof spirit, indicates the number of degrees the given sample is above or below proof.

Thus, if 100 volumes of a spirit requires 10 volumes of water to reduce it to proof spirit, it is said to be "10 over proof." If, on the other hand, 100 volumes of a spirit require 10 volumes of alcohol of 0.825 specific gravity to raise it to proof, it is said to be "10 under proof."

[2] The U. S. P. VIII gave the following Rules for making an alcohol of any required lower percentage from an alcohol of any given higher percentage: I. By Volume.—Designate the volume percentage of the stronger alcohol by *V*, and that of the weaker alcohol by *v*.

Rule.—Mix *v* volumes of the stronger alcohol with distilled water to make *V* volumes of product. Allow the mixture to stand until full contraction has taken place, and until it has cooled, then make up the deficiency in the *V* volumes by adding more distilled water.

Example.—An alcohol of 30 per cent. by volume is to be made from an alcohol of 94.9 per cent. by volume.—Take 30 volumes of the 94.9 per cent. alcohol, and add enough distilled water to produce 94.9 volumes.

II. By Weight.—Designate the weight-percentage of the stronger alcohol by *W*, and that of the weaker alcohol by *w*.

Rule.—Mix *w* parts by weight of the stronger alcohol with distilled water to make *W* parts by weight of product.

Example.—An alcohol of 50 per cent. by weight is to be made from an alcohol of 92.3 per cent. by weight.—Take 50 parts by weight of the 92.3 per cent. alcohol, and add enough distilled water to produce 92.3 parts by weight.

Uses.—Diluted alcohol is used as a menstruum in making tinctures, fluidextracts, extracts, etc. Its properties have been already fully described in connection with the various preparations. Its value consists not only in antiseptic properties, but also in its possessing the solvent powers of both water and alcohol.

Denatured Alcohol.—An act of Congress of June 7, 1906, authorized the withdrawal of alcohol from bond, without the payment of the internal revenue tax, for certain clearly defined uses in the industries and arts, provided such alcohol had been mixed, under the prescribed conditions, with denaturing substances which render it unfit for beverage purposes (see page 119).

Subsequent acts of Congress have increased the number of methods for denaturing and the uses to which the product may be applied, so that ether and chloroform are now made from suitably denatured alcohol and one of the authorized denaturing processes consists of the U. S. P. formulas for tincture of iodine and liniment of soft soap. The actual denaturing may be conducted only under Government supervision in specially licensed establishments.

The U. S. P. IX has provided alcohol tables which are useful to the pharmacist in determining the alcoholic per cent. of unknown liquids. Since the Food and Drugs Act requires a statement of the alcoholic per cent. of pharmaceuticals it is often necessary to determine this factor. By using the distillation method for alcoholic determination (see Chapter LXII) and then referring the specific gravity of the liquid to the tables on the following pages, the actual per cent. of alcohol present in the liquid may readily be determined.

It is evident that when percentage by volume is specified, the liquids should be *measured*, and when percentage by weight is used, the liquids in all cases should be *weighed*. The alcohol table gives the various percentages *both* by *weight* and by *volume*, and an examination will show clearly that there is considerable difference between weight and volume percentage. When alcohol is sold by per cent. valuation, unscrupulous dealers sometimes take advantage of the unwary when the buyer does not specify whether he wants "per cent. by volume" or per cent. by weight. It is much more satisfactory in buying alcohol to indicate clearly the strength that is wanted by inserting the specific gravity at the official temperature. Thus, an order for "Alcohol, sp. gr. 0.816 at 15.56° C. (60° F.)," cannot be susceptible of two meanings.

Pile's Rules for Diluting Alcohol.—1. To reduce alcohol to any required strength. To as many parts of the given alcohol as are indicated by the percentage required, add sufficient water to make the number of parts of the mixture equal to the percentage of the given alcohol. Example: It is desired to make an alcohol of 30 per cent. from one of 95 per cent. Take 30 fluidounces of the alcohol and add a sufficient amount of water to make 95 fluidounces.

2. To make any required quantity of any percentage. As the percentage of the alcohol given is to that of the alcohol required, so is the quantity desired to the quantity of the alcohol to be taken. And to this quantity of alcohol sufficient water must be added to make up the required quantity. Example: It is desired to make 80 fluidounces of 75 per cent. alcohol from that of 95 per cent. As $95 : 75 : : 80 : 63\frac{3}{19}$. This represents the number of fluidounces of 95 per cent. alcohol that is to be made up to 80 fluidounces by the addition of water.

By these rules no allowance is made for any subsequent contraction, and a mixture after being made should be allowed to stand for a short time for such contraction to take place, when a final amount of water is to be added to make up the full measure.

Alcoholometric Table

Temperature 15.56° C.

PERCENTAGE BY VOLUME					PERCENTAGE BY WEIGHT				
Per ‖ cent. vol.	Corresponding per cent. wt.	Sp. gr. app.* in air 15.56°/15.56°	Corr. † of sp. gr. for barometer (100 mm.)	Fractional ‡ per cent.	Per cent. wt.	Corresponding per cent. vol.	Sp. gr. app.* in air 15.56°/15.56°	Corr. † of sp. gr. for barometer (100 mm.)	Fractional ‡ per cent.
§0	0.000	1.00000	0.000000	0.0667	0	0.000	1.00000	0.000000	0.0532
1	0.795	0.99850	0.000000	0.0680	1	1.257	0.99812	0.000000	0.0543
2	1.593	0.99703	0.000000	0.0690	2	2.510	0.99628	0.000000	0.0565
3	2.392	0.99558	0.000001	0.0714	3	3.758	0.99451	0.000001	0.0588
4	3.194	0.99418	0.000001	0.0730	4	5.002	0.99281	0.000001	0.0610
5	3.998	0.99281	0.000001	0.0746	5	6.243	0.99117	0.000001	0.0641
6	4.804	0.99149	0.000001	0.0781	6	7.479	0.98961	0.000001	0.0671
7	5.612	0.99021	0.000001	0.0813	7	8.712	0.98812	0.000002	0.0680
8	6.422	0.98898	0.000002	0.0833	8	9.943	0.98665	0.000002	0.0700
9	7.234	0.98778	0.000002	0.0840	9	11.169	0.98523	0.000002	0.0719
10	8.047	0.98659	0.000002	0.0855	10	12.393	0.98384	0.000002	0.0746
11	8.862	0.98542	0.000002	0.0877	11	13.613	0.98351	0.000003	0.0769
12	9.679	0.98428	0.000002	0.0901	12	14.832	0.98120	0.000003	0.0775
13	10.497	0.98317	0.000003	0.0917	13	16.047	0.97991	0.000003	0.0800
14	11.317	0.98208	0.000003	0.0943	14	17.259	0.97866	0.000003	0.0820
15	12.138	0.98102	0.000003	0.0943	15	18.469	0.97744	0.000004	0.0840
16	12.961	0.97996	0.000003	0.0962	16	19.676	0.97625	0.000004	0.0833
17	13.786	0.97892	0.000003	0.0990	17	20.880	0.97505	0.000004	0.0826
18	14.612	0.97791	0.000004	0.1000	18	22.081	0.97384	0.000004	0.0813
19	15.440	0.97691	0.000004	0.1020	19	23.278	0.97261	0.000004	0.0806
20	16.269	0.97593	0.000004	0.1000	20	24.472	0.97137	0.000005	0.0794
21	17.100	0.97493	0.000004	0.0990	21	25.662	0.97011	0.000005	0.0781
22	17.933	0.97392	0.000004	0.0980	22	26.849	0.96883	0.000005	0.0769
23	18.768	0.97290	0.000004	0.0962	23	28.032	0.96753	0.000005	0.0752
24	19.604	0.97186	0.000005	0.0952	24	29.210	0.96620	0.000005	0.0740
25	20.443	0.97081	0.000005	0.0943	25	30.388	0.96485	0.000006	0.0719
26	21.285	0.96974	0.000005	0.0926	26	31.555	0.96346	0.000006	0.0694
27	22.127	0.96866	0.000005	0.0909	27	32.719	0.96202	0.000006	0.0667
28	22.973	0.96756	0.000005	0.0893	28	33.879	0.96052	0.000006	0.0649
29	23.820	0.96644	0.000005	0.0877	29	35.033	0.95898	0.000007	0.0633
30	24.670	0.96530	0.000005	0.0862	30	36.181	0.95740	0.000007	0.0613

* Barometer 760 mm. Air one-half saturated with moisture.

‖ If temperature of observation is above 15.56° C., look for percentage correction in the following table.

† Correction subtractive if barometer is above, additive if below, 760 mm. If barometer readings are in inches reduce to millimeters by multiplying by 25.4.

‡ Corresponding with a difference in specific gravity of 0.0001.

§ The figures on this line across the page are for fractional percentages below 1.

NOTE: The figures of these Alcoholometric Tables are based on tables issued by the U. S. Bureau of Standards.

Alcoholometric Table—*Continued*

Percentage by Volume					Percentage by Weight				
Per cent. vol.	Corresponding per cent. wt.	Sp. gr. app. in air $\frac{15.56°}{15.56°}$	Corr. of sp. gr. for barometer (100 mm.)	Fractional per cent.	Per cent. wt.	Corresponding per cent. vol.	Sp. gr. app. in air $\frac{15.56°}{15.56°}$	Corr. of sp. gr. for barometer (100 mm.)	Fractional per cent.
31	25.524	0.96414	0.000006	0.0820	31	37.323	0.95577	0.000007	0.0595
32	26.382	0.96292	0.000006	0.0787	32	38.459	0.95409	0.000007	0.0578
33	27.242	0.96165	0.000006	0.0775	33	39.590	0.95236	0.000007	0.0565
34	28.104	0.96036	0.000006	0.0752	34	40.716	0.95059	0.000008	0.0556
35	28.971	0.95903	0.000006	0.0725	35	41.832	0.94879	0.000008	0.0546
36	29.842	0.95765	0.000007	0.0704	36	42.944	0.94696	0.000008	0.0538
37	30.717	0.95623	0.000007	0.0685	37	44.050	0.94509	0.000009	0.0521
38	31.596	0.95477	0.000007	0.0668	38	45.149	0.94317	0.000009	0.0515
39	32.478	0.95326	0.000007	0.0649	39	46.242	0.94123	0.000009	0.0508
40	33.364	0.95172	0.000007	0.0633	40	47.328	0.93926	0.000010	0.0498
41	34.254	0.95014	0.000008	0.0617	41	48.407	0.93725	0.000010	0.0488
42	35.150	0.94852	0.000008	0.0600	42	49.480	0.93520	0.000010	0.0485
43	36.050	0.94687	0.000008	0.0588	43	50.545	0.93312	0.000011	0.0476
44	36.955	0.94517	0.000009	0.0578	44	51.605	0.93102	0.000011	0.0474
45	37.865	0.94344	0.000009	0.0565	45	52.658	0.92891	0.000011	0.0469
46	38.778	0.94167	0.000009	0.0552	46	53.705	0.92678	0.000012	0.0467
47	39.697	0.93986	0.000009	0.0541	47	54.746	0.92464	0.000012	0.0461
48	40.622	0.93801	0.000010	0.0526	48	55.780	0.92247	0.000012	0.0461
49	41.551	0.93611	0.000010	0.0518	49	56.808	0.92030	0.000013	0.0457
50	42.487	0.93418	0.000010	0.0510	50	57.830	0.91811	0.000013	0.0455
51	43.428	0.93222	0.000011	0.0503	51	58.844	0.91591	0.000013	0.0446
52	44.374	0.93023	0.000011	0.0498	52	59.851	0.91367	0.000014	0.0444
53	45.326	0.92822	0.000011	0.0488	53	60.854	0.91142	0.000014	0.0444
54	46.283	0.92617	0.000012	0.0483	54	61.850	0.90917	0.000014	0.0442
55	47.245	0.92410	0.000012	0.0478	55	62.837	0.90691	0.000015	0.0441
56	48.214	0.92201	0.000012	0.0474	56	63.820	0.90464	0.000015	0.0441
57	49.187	0.91990	0.000013	0.0463	57	64.798	0.90237	0.000015	0.0441
58	50.167	0.91774	0.000013	0.0457	58	65.768	0.90010	0.000016	0.0437
59	51.154	0.91555	0.000013	0.0452	59	66.732	0.89781	0.000016	0.0435
60	52.147	0.91334	0.000014	0.0446	60	67.690	0.89551	0.000016	0.0433
61	53.146	0.91110	0.000014	0.0439	61	68.641	0.89320	0.000017	0.0431
62	54.152	0.90882	0.000014	0.0437	62	69.586	0.89088	0.000017	0.0431
63	55.165	0.90653	0.000015	0.0435	63	70.523	0.88856	0.000017	0.0427
64	56.184	0.90423	0.000015	0.0429	64	71.455	0.88623	0.000018	0.0426
65	57.208	0.90190	0.000015	0.0426	65	72.380	0.88388	0.000018	0.0426
66	58.241	0.89955	0.000016	0.0420	66	73.299	0.88153	0.000019	0.0426
67	59.279	0.89717	0.000016	0.0410	67	74.211	0.87918	0.000019	0.0426
68	60.325	0.89477	0.000016	0.0408	68	75.117	0.87683	0.000019	0.0422
69	61.379	0.89232	0.000017	0.0407	69	76.016	0.87446	0.000020	0.0422
70	62.441	0.88986	0.000017	0.0403	70	76.909	0.87206	0.000020	0.0418

Alcoholometric Table—*Continued*

PERCENTAGE BY VOLUME					PERCENTAGE BY WEIGHT				
Per cent. vol.	Corresponding per cent. wt.	Sp. gr. app. in air $\frac{15.56^\circ}{15.56^\circ}$	Corr. of sp. gr. for barometer (100 mm.)	Fractional per cent.	Per cent. wt.	Corresponding per cent. vol.	Sp. gr. app. in air $\frac{15.56^\circ}{15.56^\circ}$	Corr. of sp. gr. for barometer (100 mm.)	Fractional per cent.
71	63.511	0.88738	0.000018	0.0395	71	77.794	0.86970	0.000021	0.0417
72	64.588	0.88485	0.000018	0.0392	72	78.672	0.86730	0.000021	0.0417
73	65.674	0.88230	0.000019	0.0389	73	79.544	0.86490	0.000021	0.0417
74	66.768	0.87973	0.000019	0.0385	74	80.410	0.86250	0.000022	0.0413
75	67.870	0.87713	0.000019	0.0380	75	81.269	0.86008	0.000022	0.0413
76	68.982	0.87450	0.000020	0.0376	76	82.121	0.85766	0.000022	0.0413
77	70.102	0.87184	0.000020	0.0370	77	82.967	0.85524	0.000023	0.0412
78	71.234	0.86914	0.000021	0.0365	78	83.805	0.85281	0.000023	0.0403
79	72.375	0.86640	0.000021	0.0362	79	84.636	0.85033	0.000024	0.0408
80	73.526	0.86364	0.000021	0.0357	80	85.459	0.84788	0.000024	0.0403
81	74.686	0.86084	0.000022	0.0352	81	86.275	0.84540	0.000024	0.0402
82	75.858	0.85800	0.000022	0.0350	82	87.083	0.84291	0.000025	0.0402
83	77.039	0.85514	0.000023	0.0344	83	87.885	0.84042	0.000025	0.0398
84	78.233	0.85223	0.000023	0.0337	84	88.678	0.83791	0.000025	0.0394
85	79.441	0.84926	0.000024	0.0331	85	89.464	0.83537	0.000026	0.0392
86	80.662	0.84624	0.000024	0.0326	86	90.240	0.83282	0.000026	0.0391
87	81.897	0.84317	0.000025	0.0322	87	91.008	0.83026	0.000027	0.0386
88	83.144	0.84006	0.000025	0.0314	88	91.766	0.82767	0.000027	0.0377
89	84.408	0.83688	0.000026	0.0307	89	92.517	0.82502	0.000028	0.0380
90	85.689	0.83362	0.000026	0.0300	90	93.254	0.82239	0.000028	0.0372
91	86.989	0.83029	0.000027	0.0291	91	93.982	0.81970	0.000028	0.0367
92	88.310	0.82685	0.000027	0.0282	92	94.700	0.81697	0.000029	0.0362
93	89.652	0.82330	0.000028	0.0272	93	95.407	0.81421	0.000029	0.0358
94	91.025	0.81963	0.000028	0.0262	94	96.103	0.81142	0.000030	0.0353
95	92.423	0.81581	0.000029	0.0252	95	96.787	0.80859	0.000030	0.0348
96	93.851	0.81184	0.000030	0.0240	96	97.457	0.80572	0.000030	0.0342
97	95.315	0.80769	0.000030	0.0229	97	98.117	0.80280	0.000031	0.0334
98	96.820	0.80333	0.000031	0.0214	98	98.759	0.79981	0.000031	0.0328
99	98.381	0.79865	0.000031	0.0200	99	99.386	0.79676	0.000032	0.0322
100	100.000	0.79365	0.000032		100	100.000	0.79365	0.000032	

Temperature Corrections

For volume per cent. of Alcohol by the foregoing Alcoholometric Table

Temp. C. 15.56°	Observed Per cent.—Alcohol by volume											
	1	2	3	4	5	6	7	8	9	10	12	14
	Subtract from observed Per cent. of Alcohol											
16	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.08
17	0.14	0.14	0.16	0.16	0.16	0.17	0.17	0.19	0.20	0.21	0.24	0.29
18	0.25	0.25	0.27	0.27	0.27	0.29	0.31	0.33	0.35	0.37	0.42	0.49
19	0.36	0.36	0.38	0.39	0.40	0.43	0.45	0.48	0.51	0.54	0.61	0.69
20	0.48	0.48	0.50	0.52	0.54	0.57	0.60	0.64	0.67	0.71	0.80	0.91
21	0.60	0.61	0.63	0.65	0.68	0.71	0.75	0.80	0.84	0.89	0.99	1.12
22	0.73	0.75	0.77	0.79	0.83	0.86	0.91	0.97	1.02	1.07	1.19	1.35
23	0.86	0.89	0.91	0.94	0.98	1.02	1.08	1.14	1.20	1.26	1.40	1.58
24	1.00	1.04	1.06	1.10	1.14	1.20	1.25	1.32	1.38	1.45	1.61	1.81
25		1.19	1.22	1.26	1.30	1.36	1.41	1.49	1.57	1.65	1.82	2.04
26		1.35	1.38	1.43	1.47	1.54	1.60	1.68	1.76	1.85	2.04	2.28
27		1.52	1.55	1.61	1.65	1.73	1.79	1.88	1.96	2.06	2.27	2.52
28		1.69	1.73	1.78	1.84	1.91	1.99	2.08	2.17	2.28	2.50	2.76
29		1.87	1.91	1.96	2.03	2.10	2.19	2.28	2.38	2.50	2.73	3.00
30			2.09	2.15	2.22	2.30	2.39	2.49	2.60	2.72	2.97	3.25
31			2.27	2.34	2.41	2.50	2.60	2.70	2.82	2.95	3.21	3.51
32			2.45	2.54	2.61	2.71	2.82	2.92	3.05	3.18	3.46	3.77
33			2.63	2.74	2.81	2.92	3.04	3.15	3.28	3.42	3.71	4.03
34			2.82	2.95	3.02	3.14	3.27	3.39	3.52	3.66	3.96	4.29
35				3.16	3.24	3.36	3.49	3.63	3.76	3.91	4.22	4.55

Temp. C. 15.56°	Observed Per cent.—Alcohol by volume											
	16	18	20	22	24	26	28	30	32	34	37	40
	Subtract from observed Per cent. of Alcohol											
16	0.10	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.19	0.19	0.18
17	0.33	0.38	0.42	0.46	0.50	0.54	0.57	0.59	0.60	0.60	0.59	0.58
18	0.56	0.65	0.73	0.79	0.84	0.89	0.95	0.99	1.00	1.01	1.00	0.98
19	0.80	0.91	1.02	1.11	1.19	1.27	1.33	1.39	1.40	1.41	1.41	1.39
20	1.04	1.18	1.32	1.44	1.54	1.64	1.72	1.79	1.81	1.82	1.81	1.79
21	1.28	1.45	1.61	1.76	1.88	2.00	2.10	2.18	2.21	2.22	2.22	2.19
22	1.53	1.73	1.91	2.07	2.21	2.35	2.47	2.57	2.60	2.63	2.63	2.59
23	1.78	2.00	2.21	2.39	2.55	2.71	2.84	2.95	3.00	3.03	3.03	3.00
24	2.04	2.28	2.51	2.71	2.88	3.06	3.21	3.34	3.40	3.44	3.44	3.40
25	2.29	2.56	2.81	3.03	3.22	3.41	3.58	3.73	3.80	3.84	3.85	3.80
26	2.55	2.83	3.11	3.35	3.56	3.77	3.95	4.11	4.20	4.25	4.26	4.21
27	2.80	3.11	3.41	3.68	3.91	4.13	4.32	4.50	4.59	4.65	4.67	4.62
28	3.06	3.38	3.71	4.00	4.25	4.49	4.70	4.88	4.99	5.05	5.07	5.02
29	3.32	3.66	4.01	4.33	4.60	4.85	5.06	5.26	5.38	5.46	5.48	5.43
30	3.58	3.94	4.31	4.65	4.94	5.21	5.43	5.64	5.77	5.86	5.89	5.84
31	3.85	4.22	4.61	4.97	5.28	5.56	5.80	6.01	6.16	6.26	6.29	6.24
32	4.12	4.51	4.92	5.30	5.62	5.91	6.16	6.39	6.54	6.65	6.70	6.65
33	4.40	4.80	5.22	5.62	5.95	6.26	6.50	6.76	6.92	7.04	7.10	7.05
34	4.67	5.09	5.54	5.94	6.29	6.62	6.90	7.13	7.30	7.44	7.51	7.46
35	4.94	5.39	5.86	6.27	6.63	6.97	7.26	7.50	7.67	7.83	7.91	7.86

Temperature Corrections—*Continued*

For volume per cent. of Alcohol by the foregoing Alcoholometric Table

Temp. C. 15.56°	Observed Per cent.—Alcohol by volume											
	43	46	49	52	55	58	61	64	67	70	72	76
	Subtract from observed Per cent. of Alcohol											
16	0.18	0.18	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.14
17	0.57	0.56	0.55	0.53	0.52	0.51	0.50	0.49	0.48	0.47	0.46	0.45
18	0.97	0.95	0.93	0.90	0.88	0.86	0.85	0.83	0.82	0.80	0.79	0.76
19	1.37	1.34	1.30	1.27	1.25	1.22	1.19	1.17	1.14	1.12	1.11	1.08
20	1.76	1.72	1.68	1.64	1.61	1.57	1.54	1.51	1.48	1.45	1.42	1.39
21	2.15	2.11	2.06	2.02	1.98	1.94	1.90	1.85	1.82	1.79	1.75	1.70
22	2.55	2.50	2.44	2.39	2.34	2.29	2.24	2.20	2.16	2.12	2.07	2.02
23	2.94	2.89	2.82	2.76	2.71	2.66	2.60	2.55	2.50	2.46	2.39	2.33
24	3.34	3.28	3.21	3.14	3.07	3.01	2.95	2.90	2.84	2.79	2.72	2.65
25	3.74	3.67	3.60	3.52	3.44	3.37	3.31	3.24	3.18	3.13	3.05	2.97
26	4.14	4.07	3.98	3.89	3.81	3.74	3.67	3.59	3.53	3.47	3.38	3.29
27	4.55	4.47	4.37	4.27	4.18	4.10	4.02	3.95	3.87	3.80	3.71	3.62
28	4.95	4.86	4.76	4.65	4.56	4.48	4.39	4.31	4.22	4.14	4.04	3.95
29	5.35	5.26	5.15	5.04	4.93	4.84	4.75	4.66	4.57	4.48	4.38	4.27
30	5.75	5.66	5.53	5.41	5.30	5.20	5.11	5.01	4.91	4.82	4.71	4.59
31	6.15	6.06	5.92	5.79	5.67	5.57	5.48	5.37	5.27	5.17	5.05	4.93
32	6.56	6.46	6.32	6.19	6.05	5.95	5.84	5.73	5.62	5.51	5.39	5.26
33	6.96	6.85	6.72	6.57	6.43	6.32	6.20	6.09	5.97	5.86	5.73	5.59
34	7.36	7.25	7.12	6.96	6.81	6.69	6.56	6.44	6.32	6.21	6.07	5.92
35	7.76	7.65	7.51	7.35	7.19	7.06	6.93	6.80	6.68	6.56	6.41	6.25

Temp. C. 15.56°	Observed Per cent.—Alcohol by volume										
	79	82	84	86	88	90	92	94	96	98	100
	Subtract from observed Per cent. of Alcohol										
16	0.13	0.13	0.13	0.13	0.12	0.12	0.11	0.10	0.10	0.09	0.08
17	0.44	0.42	0.41	0.41	0.39	0.38	0.36	0.33	0.31	0.27	0.24
18	0.74	0.71	0.70	0.69	0.66	0.63	0.60	0.56	0.52	0.46	0.40
19	1.04	1.00	0.98	0.96	0.93	0.89	0.85	0.79	0.73	0.65	0.57
20	1.34	1.30	1.28	1.24	1.20	1.15	1.09	1.02	0.94	0.85	0.74
21	1.66	1.60	1.57	1.53	1.47	1.42	1.34	1.26	1.16	1.05	0.92
22	1.97	1.90	1.86	1.82	1.75	1.69	1.60	1.50	1.39	1.26	1.09
23	2.27	2.20	2.15	2.10	2.03	1.96	1.86	1.75	1.61	1.46	1.27
24	2.58	2.50	2.45	2.39	2.31	2.23	2.12	1.99	1.84	1.67	1.45
25	2.89	2.81	2.75	2.68	2.60	2.50	2.38	2.23	2.07	1.88	1.63
26	3.21	3.11	3.05	2.96	2.89	2.78	2.64	2.48	2.31	2.10	1.82
27	3.52	3.42	3.35	3.27	3.17	3.05	2.91	2.74	2.54	2.31	2.00
28	3.84	3.73	3.65	3.57	3.46	3.33	3.18	2.99	2.78	2.53	2.19
29	4.16	4.04	3.96	3.86	3.74	3.61	3.45	3.25	3.02	2.75	2.38
30	4.47	4.34	4.26	4.16	4.03	3.89	3.72	3.51	3.26	2.98	2.58
31	4.79	4.66	4.56	4.46	4.32	4.18	3.99	3.77	3.51	3.21	2.78
32	5.12	4.98	4.88	4.77	4.62	4.46	4.27	4.03	3.76	3.45	2.99
33	5.45	5.30	5.19	5.07	4.92	4.75	4.54	4.30	4.01	3.68	3.19
34	5.77	5.62	5.51	5.38	5.22	5.03	4.82	4.56	4.26	3.92	3.40
35	6.09	5.94	5.82	5.69	5.52	5.32	5.09	4.82	4.52	4.15	3.61

ÆTHER. U. S. Ether

A liquid containing not less than 95.5 per cent. nor more than 97.5 per cent. of ethyl oxide [$(C_2H_5)_2O = 74.08$], the remainder consisting of alcohol containing a little water. Preserve it in partially filled, well-closed containers, in a cool place, remote from fire, and protected from daylight.

When ether is to be used for anesthesia it is to be dispensed only in small, well-closed containers and is not to be used for this purpose if the container has been opened longer than twenty-four hours.

But one ether is now official, in place of the two in the U. S. P. 1880, known as Æther and Æther Fortior; the old Æther, sp. gr. 0.750, was dropped altogether, the name Æther being now applied to what was formerly known as Æther Fortior, or "stronger ether."

Preparation.—The Pharmacopœia of 1870 contained a process for the preparation of Ether. It was rarely or never used, because this is one of the liquids which cannot be safely or profitably made upon the small scale with the usual facilities afforded by the pharmacist's laboratory. Ether is made by acting on alcohol with sulphuric acid between the temperatures of 130° and 137.7° C. (266° and 280° F.). The sulphuric acid is not consumed in the process, but is regenerated, so that the making of ether is continuous. This will be understood when the reactions are explained. Ether is the oxide of the monad radical ethyl, C_2H_5. Alcohol, as has been already stated, is the hydroxide, C_2H_5OH; now,

$$\underset{\text{Alcohol}}{C_2H_5OH} + \underset{\text{Sulphuric Acid}}{H_2SO_4} = \underset{\text{Ethylsulphuric Acid}}{C_2H_5HSO_4} + \underset{\text{Water}}{H_2O}$$

then

$$\underset{\text{Ethyl sulphuric Acid}}{C_2H_5HSO_4} + \underset{\text{Alcohol}}{C_2H_5OH} = \underset{\text{Ether}}{(C_2H_5)_2O} + \underset{\text{Sulphuric Acid}}{H_2SO_4}$$

Formerly it was believed that the sulphuric acid acted by catalysis, and that it dehydrated the alcohol through its affinity for water; but, the presence of ethylsulphuric acid, which was formed during the process, having been proved, this simple theory had to be abandoned.

It is now made from tax-free, specially denatured alcohol, and ether is consequently greatly reduced in price and may be used economically in the preparation of the oleoresins where it has again replaced acetone in the U. S. P.

Official Description.—A transparent, colorless, mobile liquid.

Odor, Taste, and Reaction.—It has a characteristic odor, and a burning and sweetish taste. The color of light blue litmus paper, moistened with water, is not changed to red when the paper is immersed in Ether for ten minutes.

Solubility.—It is soluble in about 12 times its volume of water at 25° C. (77° F.), with slight contraction of volume. Miscible with alcohol, chloroform, petroleum benzin, benzene, or fixed or volatile oils.

Specific Gravity.—0.713 to 0.716 at 25° C. (77° F.).

Tests for Identity.—Boiling point: about 35° C. (95° F.).

Ether is highly volatile and inflammable. Its vapor when mixed with air and ignited may explode violently. It is slowly oxidized by the action of air, moisture, and sunlight with the formation of peroxides.

Impurities and Tests for Impurities.—The moist residue left on the spontaneous evaporation of 30 mils of Ether from a shallow dish is odorless and neither reddens nor bleaches blue litmus paper. Dried at 100° C. (212° F.), this residue does not exceed 0.001 Gm.

Pour 10 mils of Ether in portions upon clean, odorless blotting paper and allow it to evaporate spontaneously. No foreign odor is perceptible when the last traces of Ether leave the paper.

Aldehyde.—Shake 10 mils of Ether occasionally during one hour with 1 mil of potassium hydroxide T.S. in a glass-stoppered container, protected from light; no color is developed in either liquid.

Peroxides.—Shake 10 mils of Ether occasionally during one hour with 1 mil of a freshly made solution of cadmium and potassium iodide (1 in 10), in a glass-stoppered cylinder previously rinsed with the Ether under examination and protected from light; no color develops in either liquid.

U. S. P. Preparations.—Collodium, Oleoresina Aspidii; Oleoresina Capsici; Oleoresina Petroselini; Oleoresina Piperis; Oleoresina Zingiberis; Pilulæ Ferri Iodidi; Pilulæ Phosphori; Spiritus Ætheris.

N. F. Preparations.—Mistura Chloroformi et Morphinæ Composita; Oleoresina Lupulini; Oleum Æthereum; Oleum Phosphoratum; Spiritus Ætheris Compositus; Tinctura Ferri Chloridi Ætherea; Ethereal tinctures.

Uses.—Ether is used principally as an anæsthetic, and, notwithstanding the many efforts made to supplant it, continues to be the best agent yet discovered for producing insensibility to pain in surgical operations. It is also used as a solvent. It dissolves iodine and bromine freely, and sulphur and phosphorus sparingly. Its power to dissolve corrosive sublimate makes it a useful agent in the manipulations for detecting that poison. It is also a solvent of volatile and fixed oils, many resins and balsams, tannic acid, caoutchouc, and most of the alkaloids.

Ether should be kept in well-stoppered bottles, or in soldered tins, in a cool place remote from lights and fire. Especial care should be observed in pouring ether from one vessel to another by gas light. The vapor is heavy—two and a half times as heavy as air—and it will at once take fire with explosive force on contact with flame.

Preparations of the Esters of the Ethyl and Amyl Series

OLEUM ÆTHEREUM. N. F. Ethereal Oil

[Ol. Æther.]

A volatile liquid consisting of equal volumes of heavy oil of wine and ether.

	Metric	Old form
Alcohol	**1000 mils**	2 pints
Sulphuric Acid	**1000 mils**	2 pints
Distilled Water	**25 mils**	384 min.
Ether, a sufficient quantity.		

Add the sulphuric acid slowly to the alcohol, mix them thoroughly, and allow the mixture to stand, in a closed flask, for twenty-four hours, or until the liquid is clear; then pour the clear liquid into a tabulated retort of such capacity that the mixture shall nearly fill it. Insert a thermometer through the tubulure, so that the bulb shall be deeply immersed in the liquid, and, having connected the retort with a well-cooled condenser, and also having connected a bent glass tube with the receiver for conducting the uncondensed gases into water, distil, by means of a sand bath, at a temperature between 150° and 160° C. (302°–320° F.), until oily drops cease to come over, or until a black froth, which forms on the surface, begins to rise in the retort. Separate the yellow, ethereal liquid from the distillate, and expose it to the air for twenty-four hours, in a shallow dish. Then transfer it to a wet filter, and, when the aqueous portion has drained off, wash the oil which is left on the filter with the distilled water, which must be as cold as possible. When this also has drained off, transfer the oil to a graduated measure, and add to it an equal volume of ether. Preserve the product in small, glass-stoppered bottles, in a cool place.

Official Description.—A transparent, nearly colorless, volatile liquid.

Odor, Taste, and Reaction.—It has a peculiar, aromatic, ethereal odor, and a pungent, refreshing, bitter taste; neutral to dry litmus paper.

Specific Gravity.—About 0.905 at 25° C. (77° F.).

Esters, as already explained, are produced by the action of acids on alcohols (page 1050). Ethereal oil is a mixture of esters.

If alcohol is distilled with a large excess of sulphuric acid, there are formed toward the close of the distillation heavy oil of wine, sulphurous acid, olefiant gas, and empyreumatic products. The product of the distillation is generally in two layers, one consisting of water holding sulphurous acid in solution, and the other, of ether containing the heavy oil of wine. After separation, the latter liquid is exposed for twenty-four hours to the air, in order to dissipate the ether by evaporation, and the oil which is left is washed with water to deprive it of all traces of sulphurous acid.

In the early stage of the distillation of a mixture of sulphuric acid and alcohol, ethylsulphuric acid, $C_2H_5HSO_4$, is formed. During its progress, this is decomposed so as to yield ether. When, however, the alcohol is distilled with a large excess of sulphuric acid, the ethylsulphuric acid is decomposed so as to form a small quantity of the *heavy oil of wine.* This is a mixture of ethyl sulphate, $(C_2H_5)_2SO_4$, ethyl sulphite, $(C_2H_5)_2SO_3$ (the sulphurous acid having been formed by reduction of sulphuric acid), with polymeric forms of ethylene, C_2H_4.

Uses.—Ethereal oil is used solely as an ingredient in compound spirit of ether, but commercial *Hoffmann's anodyne* (see page 391) is usually bought by the pharmacist and substituted for this preparation. It differs from the official liquid in containing variable proportions of light and heavy oil of wine, ether, and alcohol. It is obtained as a supplementary product by the manufacturing chemist.

During the rectification of crude ether, the distillation is continued as long as ether of the proper specific gravity comes over; after which the receiver is changed, and an additional distillate is obtained, consisting of ether and alcohol impregnated with a little ethereal oil. It is this second distillate, variously modified by the addition of alcohol, ether, or water, so as to make it conform in taste, smell, opalescence, etc., to a standard preparation kept by the manufacturer, that is sold as Hoffmann's anodyne.

The expensiveness of the ethereal oil is alleged to be the cause of this substitution. The cheap commercial liquid may be known by adding it to water; it usually mixes without causing milkiness. The official compound spirit of ether produces a slight opalescence when forty drops are added to a pint of water, and the peculiar odor of ethereal oil is distinctly noticed; but castor oil is sometimes added by dishonest manufacturers to circumvent this test. This fraud may be detected by mixing equal parts of the suspected liquid and water, and collecting the oil which separates on a piece of filtering paper and exposing it to heat. A permanent greasy stain indicates a fixed oil, while an ethereal oil stain disappears on heating.

SPIRITUS ÆTHERIS NITROSI. U. S. Spirit of Nitrous Ether.
[Sp. Æth. Nitros.—SWEET SPIRIT OF NITRE]

An alcoholic solution of ethyl nitrite [$C_2H_5NO_2 = 75.05$], containing not less than 3.5 per cent. nor more than 4.5 per cent. of $C_2H_5NO_2$.

The object of the official process, which will be found on pages 385 and 386, is to form ethyl nitrite, an ester produced by substituting the acid radical for the hydrogen of the hydroxyl in the alcohol. This is then preserved from decomposition by the addition of sufficient alcohol. The U. S. P. process differs from formerly official methods for obtaining the nitrous radical. The use of nitric acid was abandoned in the 1890 process, and sodium nitrate introduced, so as to avoid the production of aldehyde, and to furnish a more easily controlled process than the one previously employed. In the Eighth Decennial Revision of the U. S. P., the earlier distillation process was supplanted by the simple "cold" method of separating the two immiscible liquids, after the reaction (which has been carried out in a cooled flask) is complete. This process is retained in the U. S. P. IX. The ethyl nitrite is washed, freed from water, and then diluted with the required amount of alcohol. The sulphuric acid decomposes the sodium nitrite, the nitrous radical combining with the ethyl of the alcohol to form ethyl nitrite. The dilution of the sulphuric acid and the use of a solution of sodium nitrite prevent too rapid action. Experience with the new process has demonstrated its advantages for use on a small scale.

$$\underset{\text{Alcohol}}{2C_2H_5.OH} + \underset{\text{Sodium Nitrite}}{2NaNO_2} + \underset{\text{Sulphuric Acid}}{H_2SO_4} = \underset{\text{Ethyl Nitrite}}{2C_2H_5NO_2} + \underset{\text{Sodium Sulphate}}{Na_2SO_4} + \underset{\text{Water}}{2H_2O}$$

Pure ethyl nitrite is pale yellow, has the smell of apples, boils at 18° C. (64.4° F.), and has the specific gravity 0.900 at 15.56° C. (60° F.). The density of its vapor is 2.627. Litmus is not affected by it. It is soluble in forty-eight parts of water, and in all proportions in alcohol or rectified spirit. It is highly inflammable, and burns with a white flame without residue. Mixed with an alcoholic solution of potassium hydroxide it becomes dark brown, showing the presence of aldehyde. When kept, it becomes acid in a short time, as shown by litmus, and nitric oxide is given off, which often causes the bursting of the bottle. Its tendency to become acid is rendered greater by the action of the air, and depends on the absorption of oxygen by the aldehyde which is converted into acetic acid. These facts show the necessity of preserving the spirit in small, well-stoppered, dark amber-colored bottles, in a cool and dark place, remote from fires, as required by the Pharmacopœia, and, in warm weather, of cooling the stock bottle thoroughly before opening it. The pharmacist should abandon the custom of keeping the solution in the regular glass-stoppered shop bottle, partially filled and exposed to heat and light. This need not be a hardship, however, as the spirit may be placed in suitable small bottles, as soon as prepared, and be ready for dispensing or sale without further handling.

Spirit of nitrous ether is frequently prepared by mixing pure ethyl nitrite directly with the specified volume of alcohol, the ethyl nitrite being bought in hermetically sealed tubes holding just sufficient ethyl nitrite for one pint of the official spirit. These tubes should be well-cooled, and the narrow neck plunged beneath the alcohol, before opening. It is well to wrap the tube in a towel before carrying out this operation, as the tubes have been known to explode violently.

The U. S. P. IX describes spirit of nitrous ether as follows:

Official Description.—A clear, mobile, volatile, and inflammable liquid of a pale yellow or faintly greenish-yellow tint.

Odor, Taste, and Reaction.—It has a fragrant, ethereal, and pungent odor free from acridity, and a sharp, burning taste. When freshly prepared, or even after being kept for some time with but little exposure to light and air, it is neutral to dry litmus paper. When long kept or after having been exposed to light and air, it acquires an acid reaction. Effervescence must not result when a crystal of potassium bicarbonate is added.

Specific Gravity.—Not above 0.823 at 25° C. (77° F.).

Tests for Identity.—Immerse a test tube half filled with the Spirit in a water bath heated to 65° C. (149° F.) until it has acquired that temperature; the Spirit distinctly boils upon the addition of a few small pieces of broken glass.

Impurities and Tests for Impurities.—*Aldehyde.*—Mix 10 mils of the Spirit with 5 mils of potassium hydroxide T.S., previously diluted with 5 mils of distilled water; the mixture assumes a yellow color which does not turn decidedly brown within twelve hours.

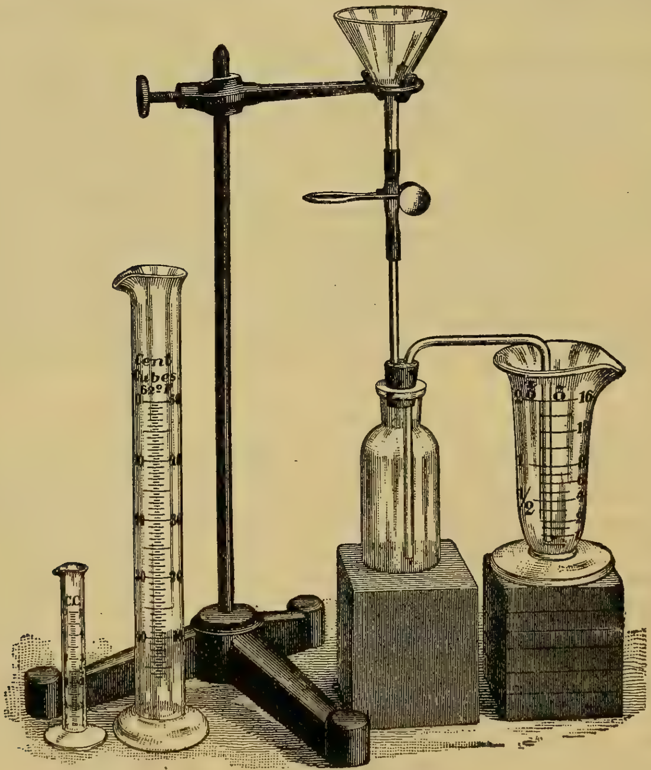
Assay.—Transfer about 40 mils of Spirit of Nitrous Ether, which has been previously shaken with 0.5 Gm. of powdered potassium bicarbonate, to a tared, 100-mil measuring-flask, and weigh it accurately. Add sufficient alcohol to bring the volume to exactly 100 mils and mix thoroughly. Introduce into a nitrometer (see U. S. P., Gasometric Estimations, Chapter LXII) exactly 10 mils of the alcoholic solution, follow it by 10 mils of potassium iodide T.S., and afterwards by 5 mils of diluted sulphuric acid. When the volume of gas has become constant (within thirty to sixty minutes), note the volume of gas collected. Multiply this volume in mils by 0.307, and divide the product by one-tenth of the weight in grammes of the Spirit of Nitrous Ether taken. At standard temperature and pressure, the quotient represents the percentage of ethyl nitrite in the liquid. The temperature correction is one-third of 1 per cent. of the total percentage just found for each degree, additive if temperature is below, subtractive if above, 25° C. (77° F.). The barometric correction is four-thirtieths of 1 per cent. of the total percentage just found for each mm., additive if above, subtractive if below, 760 mm.

Spirit of nitrous ether is never quite free from aldehyde, and, if made by distillation and the heat too long continued, it is apt to contain a good deal of this liquid, which afterwards becomes acetic acid by absorbing oxygen. The change goes on rapidly if the preparation be insecurely kept. Aldehyde, if in considerable proportion, may be detected by imparting a pungent odor and acrid flavor, and by the preparation assuming a brown tint on the addition of a weak solution of potassium hydroxide, owing to the formation of aldehyde resin. The official potassium hydroxide test, with the best specimens, produces a straw-yellow tint within twelve hours.

Specific gravity cannot be relied upon as a test of the quantity of ethyl nitrite present, because both it and water are heavier specifically than the diluting liquid, alcohol. The specific gravity of alcohol being 0.809 at 25° C. (77° F.), and that of spirit of nitrous ether 0.823 at 25° C. (77° F.), it follows that the heavier specific gravity of the latter should be caused by the addition of ethyl nitrite, sp. gr. 0.900 at 15.56° C. (60° F.), but the specific gravity may be increased and the product cheapened by substituting water (sp. gr. 1.000), or by using alcohol of the specific gravity 0.823, and this is a common practice with adulterators.

The nitrometer test is regarded as the only reliable one to determine the quantity of ethyl nitrite in this spirit, and the very practical apparatus shown in Fig. 447 has been devised by Dr. Squibb for the use of pharmacists who do not possess a nitrometer. This consists of a small glass funnel, a section of rubber tubing, spring pinchcock, straight glass tube, one tube bent twice at right angles, not over $\frac{1}{12}$-inch bore, a cork with two holes for the tubes, a three-ounce vial, and some wooden blocks. In using this for testing, the bottle is filled with mercury nearly to the lip. The cork holding the tubes is then pushed into the bottle, which causes the mercury to flow into the tube; the cork is now coated with melted paraffin to prevent leakage, and the funnel connected with the upright tube and the pinchcock closed, then about 20 minims of mercury are poured into the funnel and cautiously allowed to flow into the vial by slowly opening the pinchcock until the bent tube is nearly filled with mercury. There must, of course, be no leakage in the apparatus. One fl. dr. (about 48.7 grains) of spirit of nitrous ether is measured into the funnel and allowed to flow into the vial, followed by 162 minims of potassium iodide T.S. (see official test, above), and then 162 minims of normal sulphuric acid V.S. and the pinchcock tightly closed. As these liquids

Fig. 447



Nitrometer for druggists' use (Squibb)

are added to the mercury in the bottle they displace an amount of mercury equal to their own volume (384 minims), and this must be deducted from the total amount of mercury in the receiving vessel after the reaction is over, to obtain the volume which has been displaced by the generated gas. The reaction soon begins, but it should be allowed to continue for at least ten minutes before reading the result. When the reaction is over, the receiving measure may be taken away and the quantity of mercury read off; the mercury remaining in the tube runs back into the bottle as it should. If the measure of mercury, in minims, displaced by the gas, be multiplied by 0.307 and the product divided by the 48.7 grains of spirit of nitrous ether originally taken, the result will be the percentage of ethyl nitrite in the sample tested.

(It should be understood that this method yields only approximately correct results; whenever possible the official assay should be followed.)

Uses.—Spirit of nitrous ether is a valuable diaphoretic and diuretic. The dose is thirty minims to one fluidrachm (2 to 4 mils).

ÆTHYLIS CHLORIDUM. U. S. Ethyl Chloride
[Æthyl. Chlor.]

Monochlorethane [C_2H_5Cl or $CH_3CH_2Cl = 64.50$]. Preserve it in hermetically sealed containers, in a cool place, remote from fire, and protected from light.

Preparation.—Ethyl chloride may be made by distilling a mixture of equal measures of concentrated hydrochloric acid and alcohol, passing the vapor through a wash bottle to separate water, and finally condensing the vapor with the aid of ice or snow surrounding the receiver.

Official Description.—When liberated at ordinary room temperature from its sealed container Ethyl Chloride vaporizes at once; *the gas is very inflammable, and must not be used in proximity to fire.* At low temperatures or under pressure Ethyl Chloride is a colorless, mobile, very volatile liquid.

Odor, Taste, and Reaction.—It has a characteristic, ethereal odor, and a burning taste.

Solubility.—It is slightly soluble in water, freely soluble in alcohol and in ether.

Specific Gravity.—About 0.921 at 0° C. (32° F.).

Ethyl Chloride boils between 12° and 13° C. (53.6°–55.4° F.).

Tests for Identity.—It burns with a smoky, greenish flame, with the production of hydrogen chloride.

Impurities and Tests for Impurities.—*Hydrochloric Acid.*—Dissolve about 1 mil of Ethyl Chloride in 20 mils of alcohol, both previously cooled to the temperature of melting ice, and add a few drops of silver nitrate T.S.; no turbidity is produced at once.

Alcohol.—Shake 10 mils of Ethyl Chloride with 10 mils of distilled water, both previously cooled to the temperature of melting ice, and allow the supernatant stratum of Ethyl Chloride to evaporate spontaneously. The residual liquid is neutral to litmus, and on adding to it a few drops of potassium dichromate T.S., followed by some diluted sulphuric acid, and boiling the mixture, no odor of aldehyde is developed, and no greenish or purplish color is produced in the liquid.

On the spontaneous evaporation of 5 mils of Ethyl Chloride, no foreign odor is noticeable while the last portions evaporate and no weighable residue remains.

Uses.—Ethyl chloride is used as a local anæsthetic by freezing; its great volatility requires special methods for dispensing; hermetically sealed tubes are used, so made that when the end is broken off, or the metallic orifice opened, and the tube held in the hand, the expansion drives the liquid out in a fine stream which is directed against the part to be anæsthetized.

ÆTHYLIS CARBAMAS. U. S. Ethyl Carbamate

[Æthyl. Carbam.]

The ethyl ester [$C_3H_7O_2N$ or $CO(OC_2H_5)NH_2=89.07$] of carbamic acid. Preserve it in well-closed containers.

Preparation.—It is made by acting upon *urea nitrate* with alcohol in excess, in closed vessels at a temperature of 120° to 130° C. (248° to 266° F.); ammonia is liberated.

Official Description.—It occurs in colorless, columnar crystals or scales.

Odor, Taste, and Reaction.—Odorless and having a cooling, saline taste. Its aqueous solution (1 in 20) is neutral to litmus.

Solubility.—One Gm. of Ethyl Carbamate dissolves in 0.45 mil of water, 0.8 mil of alcohol, 2.5 mils of glycerin, 0.9 mil of chloroform, 1.5 mils of ether, and in 32 mils of olive oil, at 25° C. (77° F.).

Tests for Identity.—Ethyl Carbamate melts between 48° and 50° C. (118.4° and 122° F.).

Add 1 Gm. of Ethyl Carbamate to 5 mils of sulphuric acid and heat it gently; decomposition follows with the evolution of carbon dioxide (alcohol and acid ammonium sulphate remain in solution).

Heat 1 Gm. of Ethyl Carbamate with 5 mils of concentrated potassium hydroxide solution; ammonia gas is given off, recognizable by its odor.

Dissolve about 0.5 Gm. of Ethyl Carbamate in 5 mils of distilled water with about 1 Gm. of dry sodium carbonate and about 0.01 Gm. of iodine, and warm the solution; yellow crystals of iodoform separate on cooling.

Impurities and Tests for Impurities.—Incinerate about 2 Gm. of Ethyl Carbamate; not more than 0.05 per cent. of ash remains.

Urea.—Dissolve about 2 Gm. of Ethyl Carbamate in 2 mils of distilled water and add 5 mils of nitric acid to the solution; no white precipitate is produced.

Chloride.—Not more than slight opalescence results from the addition of a few drops of silver nitrate T.S. to 10 mils of an aqueous solution of Ethyl Carbamate (1 in 20).

Nitrate.—Mix 2 mils of the aqueous solution (1 in 20) with 1 mil of ferrous sulphate T.S. and pour the mixture upon 2 mils of sulphuric acid, so as to form a separate layer; no red or brown zone appears.

Uses.—Ethyl carbamate or *urethane* is used as an hypnotic in doses of fifteen grains (1 Gm.).

SULPHONMETHANUM. U. S. Sulphonmethane

[Sulphonmeth.—SULPHONAL]

Diethylsulphonedimethylmethane [$C_7H_{16}S_2O_4$ or $(CH_3)_2C(SO_2C_2H_5)_2=228.27$]. Preserve it in well-closed containers.

Preparation.—Sulphonmethane or *Sulphonal* may be made by agitating mercaptol, obtained by the condensation of acetone with ethylmercaptan, with a 5 per cent. solution of potassium permanganate until the color of the solution remains unchanged, thus showing that the oxidation is completed. The crystals are purified by redissolving in water or alcohol, and evaporating the solution, collecting, and drying the product.

Official Description.—It occurs in colorless, prismatic crystals, or as a crystalline powder.

Odor and Taste.—Inodorous, and nearly tasteless.

Solubility.—One Gm. of Sulphonmethane dissolves in 365 mils of water, 60 mils of alcohol, 11 mils of chloroform, and in 64 mils of ether at 25° C. (77° F.); also in 16 mils of boiling water and 3 mils of boiling alcohol; soluble in benzene.

Tests for Identity and Purity.—It melts between 124° and 126° C. (255.2° and 258.8° F.).

In other respects it responds to the tests for identity and purity under *Sulphonethylmethanum.*

Uses.—Sulphonmethane is used as an hypnotic and sedative in doses of twelve to fifteen grains (0.75-1 Gm.).

SULPHONETHYLMETHANUM. U. S. Sulphonethylmethane

[Sulphonethylmeth.—TRIONAL]

Diethylsulphonemethylethylmethane [$C_8H_{18}S_2O_4$ or $(CH_3)(C_2H_5)C(SO_2C_2H_5)_2=242.28$]. Preserve it in well-closed containers.

Preparation.—Sulphonethylmethane or *Trional* is made by the same process as that employed in making sulphonal (see page 1068), except that in making the mercaptol, acetone is replaced by methylethylketone, thus substituting an ethyl for a methyl group.

Official Description.—It occurs in colorless, lustrous, crystalline scales.

Odor, Taste, and Reaction.—Odorless and having a bitter taste in aqueous solution. Its saturated aqueous solution is neutral to litmus.

Solubility.—One Gm. of Sulphonethylmethane dissolves in 200 mils of water at 25° C. (77° F.); more soluble in boiling water; soluble in alcohol or ether.

Tests for Identity.—It melts between 74° and 76° C. (165.2° and 168.8° F.); at a higher temperature it is decomposed with the evolution of sulphur dioxide.

Heat about 0.1 Gm. of Sulphonethylmethane with an equal weight of powdered charcoal in a dry test tube; the characteristic, unpleasant odor of mercaptan is developed.

Impurities and Tests for Impurities.—Incinerate about 2 Gm. of Sulphonethylmethane; not more than 0.05 per cent. of ash remains.

Sulphate.—About 1 Gm. of Sulphonethylmethane dissolved in 50 mils of boiling distilled water develops no odor. Ten mil portions of this solution, after cooling and filtering, when tested separately, show no turbidity at once on the addition of a few drops of barium chloride T.S.

Chloride.—Or a few drops of silver nitrate T.S.

Readily Oxidizable Impurities.—Twenty mils of the cold filtrate from the preceding test does not at once decolorize 0.05 mil of tenth-normal potassium permanganate V.S.

Uses.—Sulphonethylmethane is used as an hypnotic and sedative in doses of twelve to fifteen grains (0.75-1 Gm.).

AMYLIS NITRIS. U. S. Amyl Nitrite

[Amyl. Nitris]

A liquid containing not less than 80 per cent. of $C_5H_{11}NO_2$ (117.10) (chiefly iso-amyl nitrite). Preserve it in hermetically sealed glass bulbs, or in glass-stoppered vials, in a cool place, protected from light.

Preparation.—This ester may be made by acting on amyl alcohol with nitric acid. The latter is deoxidized into nitrous acid, which acts on amyl alcohol, as shown in the reaction.

$$\underset{\text{Amyl Alcohol}}{C_5H_{11}OH} + \underset{\text{Nitrous Acid}}{HNO_2} = \underset{\text{Amyl Nitrite}}{C_5H_{11}NO_2} + \underset{\text{Water}}{H_2O}$$

Tanner's process, which is adapted for small operations, is as follows: 10 fl. oz. of purified amyl alcohol is introduced into a large tubulated retort containing copper wire, 1 fl. oz. of strong sulphuric acid is now added, and then 1 fl. oz. of nitric acid, previously diluted with an equal bulk of water. It is gently heated to 63° C. (145.4° F.). At this temperature the reaction commences, and goes on very quietly until a bulk about equal to double the quantity of nitric acid collects in the receiver. The chemical action now ceases, and the temperature, which has risen to near 100° C. (212° F.), begins to fall. More diluted nitric acid is added, and the process carried out as before. These additions are repeated until the amyl alcohol is exhausted, which is known by the appearance of red fumes in the retort. The whole product is washed with sodium hydroxide, to remove hydrocyanic and other acids, and rectified over potassium carbonate, to free it from moisture. The portion which distils over between 95° and 100° C. (203° and 212° F.) is medicinally pure amyl nitrite.

Difficulties are experienced in rectifying amyl nitrite on account of the number of products present having similar boiling points. If strong nitric acid is used instead of diluted acid, explosions are almost sure to occur.

Official Description.—A clear, yellowish liquid.

Odor and Taste.—Of a peculiar, ethereal, fruity odor and a pungent, aromatic taste.

Solubility.—It is almost insoluble in water, miscible with alcohol or ether.

Specific Gravity.—0.865 to 0.875 at 25° C. (77° F.).

Tests for Identity.—Amyl Nitrite is very volatile, even at a low temperature, and is inflammable, burning with a yellow, luminous and sooty flame.

Add 2 mils of sulphuric acid to a mixture of 2 drops of Amyl Nitrite and 2 drops of water; amyl valerate is produced, recognizable by its odor on dilution with water.

Add a few drops of Amyl Nitrite to a mixture of 1 mil of ferrous sulphate T.S. and 5 mils of diluted hydrochloric acid; a greenish-brown color is produced.

Impurities and Tests for Impurities.—*Free Acid.*—Mix 1 mil of normal potassium hydroxide V.S. and 10 mils of distilled water in a test tube with a drop of phenolphthalein T.S. and add 5 mils of Amyl Nitrite; after inverting the tube a few times, the red tint of the aqueous layer is still perceptible.

Aldehyde.—A mixture of 1.5 mils of silver nitrate T S. and 1.5 mils of alcohol with a few drops of ammonia water does not become brown or black on adding 1 mil of Amyl Nitrite and gently heating the mixture.

Assay.—Transfer about 3 mils of Amyl Nitrite, which has been previously shaken with 0.5 Gm. of potassium bicarbonate and carefully decanted, to a tared 100-mil measuring-flask, containing about 20 mils of alcohol, and weigh it accurately. Add sufficient alcohol to bring the volume to exactly 100 mils and mix thoroughly. Introduce into a nitrometer (see U. S. P., Test No. 19, Chapter LXII) exactly 10 mils of the alcoholic solution, followed by 10 mils of potassium iodide T.S., and afterwards by 5 mils of diluted sulphuric acid. When the volume of gas has become constant (within thirty to sixty minutes), note the amount collected, multiply this volume in mils by 4.8 and divide the product by the original weight in grammes of the Amyl Nitrite. At standard temperature and pressure, the quotient represents the percentage of Amyl Nitrite in the liquid. The temperature correction is one-third of one per cent. of the total percentage just found for each degree—additive if the temperature is below 25° C. (77° F.), and subtractive if it is above 25° C. (77° F.). The barometric correction is four-thirtieths of one per cent. of the total percentage just found for each millimeter—additive if it is above 760 mm., and subtractive if it is below 760 mm.

Uses.—Amyl nitrite is a valuable remedy. It is exceedingly volatile, and is much used in asthma, angina pectoris, and similar complaints, by inhalation. It is a stimulant, producing an excessive action of the heart, and may be administered by dropping a small quantity on a handkerchief and inhaling the vapor, or by crushing a glass *pearl of amyl nitrite* in the handkerchief and inhaling the liquid which volatilizes. The official dose is three minims (0.2 mil).

ÆTHER ACETICUS. N. F. Acetic Ether

(U.S.P. VIII)

[Æth. Acet.—Ethyl Acetate]

A liquid containing not less than 96 per cent., by volume, of $C_4H_8O_2$ or $CH_3CO.OC_2H_5$ (88.06), the remainder consisting of alcohol and a little water. Preserve it in well-stoppered bottles, in a cool place, remote from fire and protected from light.

Preparation.—Hager's process may be used for making this ester: 440 Gm. of official sulphuric acid are added slowly to 250 Gm. of official alcohol contained in a flask, and the mixture allowed to stand for two or three days to permit the formation of ethylsulphuric acid; then 325 Gm. of sodium acetate, previously dried by heating it at a temperature of

130° C. (266° F.), until its weight remains constant, are introduced into a retort connected with a well-cooled receiver; the acid and alcohol mixture is slowly added, heat carefully applied, and the distillation continued as long as vapors of ethyl acetate come over.

$$\underset{\substack{\text{Sodium}\\\text{Acetate}}}{NaC_2H_3O_2} + \underset{\substack{\text{Ethylsulphuric}\\\text{Acid}}}{C_2H_5HSO_4} = \underset{\text{Ethyl Acetate}}{C_2H_5C_2H_3O_2} + \underset{\substack{\text{Acid Sodium}\\\text{Sulphate}}}{NaHSO_4}$$

Ethylsulphuric acid is formed through the action of the sulphuric acid and heat upon the alcohol. This is then decomposed by contact with sodium acetate, while ethyl acetate and acid sodium sulphate are produced.

Official Description.—A transparent, colorless liquid.

Odor, Taste, and Reaction.—Of a fragrant and refreshing, slightly acetous odor, and a peculiar acetous and burning taste. It does not immediately redden blue litmus paper.

Specific Gravity.—0.887 to 0.895 at 25° C. (77° F.).

Solubility.—One mil of Acetic Ether is soluble in about 10 mils of water at 25° C. (77° F.); miscible with alcohol, ether, or fixed or volatile oils.

Boiling point: from 72° to 77° C. (161.6°–170.6° F.).

Tests for Identity.—Acetic Ether is readily volatilized, even at a low temperature. It is inflammable, burning with a yellowish flame and an acetous odor.

Impurities and Tests for Impurities.—No weighable residue remains on evaporating 10 mils of Acetic Ether.

Butylic or Amylic Derivatives.—Allow 10 mils of Acetic Ether to evaporate spontaneously from clean, odorless blotting paper; the final odor does not resemble that of pineapple.

Readily Carbonizable Organic Impurities.—Pour carefully 2 mils of Acetic Ether on 10 mils of sulphuric acid; no dark ring is developed at the point of contact of the two layers within fifteen minutes.

Methyl Alcohol.—Mix 20 mils of Acetic Ether with a solution of 20 Gm. of sodium hydroxide in 50 mils of distilled water, allow the mixture to stand, agitating occasionally, or heat it gently under a reflux condenser, until a homogeneous liquid results, and then distil about 25 mils. This distillate complies with the Test for absence of methyl alcohol under *Alcohol* (see page 1053).

Undue Proportion of Alcohol or Water.—Shake 25 mils of Acetic Ether in a graduated tube, with 25 mils of distilled water just previously saturated with Acetic Ether; the ethereal layer when separated measures not less than 24 mils.

N. F. Preparations.—Elixir Formatum Compositum; Elixir Gentianæ Glycerinatum; Liquor Ferri Peptonati; Liquor Ferri Peptonati et Mangani Spiritus Odoratus.

Uses.—Acetic ether is sometimes employed as an anesthetic. Its odor is frequently noticed in old tinctures and extemporaneous mixtures which have once contained alcohol and acetic acid. Dose, fifteen minims (1 mil).

QUESTIONS ON DERIVATIVES OF SUGAR THROUGH THE ACTION OF FERMENTS

What is fermentation, and what is the difference between fermentation and putrefaction? (See page 1049.)
What are the two theories of fermentation?
Into what two classes may ferments be divided?
What are the necessary conditions to cause cane sugar to undergo vinous fermentation?
What is the probable action of the ferment?
Explain the reactions which take place in the conversion of cellulin or starch, first, into maltose, then into glucose, then into alcohol, and finally into acetic acid.
What is the most important derivatives of sugar by the action of a ferment?
What are the sources of the various ardent spirits of commerce? Of brandy? Rum? Whisky? Holland gin? Common gin? Arrack?
Compressed yeast—What is the Latn title? What is yeast? Describe its appearance, odor, and reaction.
For what is it used in the N. F.?
What are ethers? What are compound ethers?
Explain the reaction which occurs when alcohol is decomposed by acetic acid.
Whisky—What was the Latin official name? How is it defined?
How is it obtained, and what are the operations termed by which it is obtained from grain?
Describe it. What is its specific gravity?
What is its alcoholic strength?
How may the following impurities be detected?—More than traces of fusel oil from grain; an undue amount of solids; glycerin, added sugar, or spices; traces of oak tannin from casks; an undue amount of free acid.
What are its uses?
Alcohol—Describe it and give its specific gravity.
How much ethyl alcohol does it contain?
Give its formula in symbols.
What are the natural sources of alcohol, and how is it made?
How much alcohol, specific gravity 0.835, is obtained from good whisky?
What is its principal impurity?
How may it be deprived of odor?
What is meant by absolute alcohol? What is "dehydrated alcohol"?
What is the strongest alcohol which can be obtained by simple distillation?
How may it be freed from water?
Alcohol of what specific gravity may be obtained by the use of lime?
Describe the appearance, odor, and taste of dehydrated alcohol. What is its specific gravity?
How may an undue amount of water be detected?
What is its boiling point, and to what degree of cold may it be reduced without congealing?
What is alcohol chemically?
What strengths of alcohol are official?
What is "cologne spirit"?
Describe the appearance, odor, taste, chemical reaction, and solubility of alcohol.
How may it be identified?
How may the following impurities be detected?—Fusel oil constituents; amyl alcohol or non-volatile, carbonizable, organic impurities; aldehyde or oak tannin; organic impurities.
Describe the test for the presence of methyl alcohol.
Why was deodorized alcohol dropped?
What uses has alcohol in pharmacy?
What is the composition of diluted alcohol? How is it prepared? How much absolute alcohol does it contain? What is its specific gravity?
How is it made?
How may it be made from alcohol of greater than the official strength?
If 55 gallons of alcohol be mixed with 45 gallons of water, how much will the mixture measure?
What is the difference between diluted alcohol and United States proof spirit?

What is meant by alcohol being "above proof"? "below proof"?
What is the specific gravity of the latter?
What are the uses of diluted alcohol?
What is denatured alcohol?
Ether—What is its composition?
Give the formula in symbols of ethyl oxide?
How is ether made?
Describe the chemical reaction involved.
Describe its appearance, odor, taste, chemical reaction, and solubility.
What is its specific gravity? Give tests for identity.
How may the following impurities be detected?—Residue; foreign odor; aldehyde; peroxides.
What are its uses?
What precautions are necessary in using it?
What is ethereal oil? What is the Latin official name?
How is it made?
Give description and specific gravity.
What is ethyl-sulphuric acid?
If alcohol is distilled with a large excess of sulphuric acid, what is formed?
What are the physical properties of ethereal oil?
What is its use?
Spirit of nitrous ether—What is the Latin official name? What is its synonym?
How much ethyl nitrite should it contain?
Give formula in symbols.
How is it made?
How does the U. S. P. IX process for its preparation differ from that official in the U. S. P. 1890?
What is the object of this process?
How does the Pharmacopœia direct that it shall be preserved?
Pure ethyl nitrite—What is the specific gravity?
Give odor, taste, chemical reaction.
By what method is spirit of nitrous ether often prepared by the pharmacist?
What precautions are necessary when using a tube of ethyl nitrite?
Describe the official spirit.
What impurity is always present and what change results from its presence?
If in considerable proportion, how may it be detected?
Is its specific gravity a reliable test of the amount of ethyl nitrite present? Why?
Describe the official assay method.
Describe the simplified assay method devised by Dr. Squibb.
What are its uses and the dose?
Ethyl chloride—What is the Latin title? Give the chemical name and chemical formula in symbols. How may it be prepared? How is this liquid preserved, and why this precaution? Describe its physical characteristics, odor, taste, and solubility. Give the tests for identity.
How may the following impurities be detected?—Hydrochloric acid; alcohol; foreign odors.
For what is this liquid used in medicine?
Ethyl carbamate—Give the Latin title and chemical formula in symbols. What is this substance? How may it be made?
Describe appearance, odor, taste, and solubility. What are the tests for identity?
How may the absence of urea, chloride, and nitrate be determined?
By what name is it commonly known? For what is it used in medicine? Give the dose.
Sulphonmethane—What is the chemical name? What is the common name by which it is known? How is it made?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the impurity of chlorides, sulphates, and readily oxidizable organic impurities be detected? For what is it used and what is the dose?
Sulphonethylmethane—Give chemical name, chemical formula in symbols, Latin title, and common name. How is it made?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity and impurities.
For what is it used and what is the dose?

Amyl nitrite—What is the Latin official name?
Give formula in symbols.
What per cent. of absolute amyl nitrite should it contain?
How may it be made?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Free acid; aldehyde; water.
What is Tanner's process for preparing it?
What is the dose?
For what is it used medicinally and in what form?
How is it administered?
Acetic ether—What is the Latin official name and the chemical name?
Give the formula in symbols.
How may it be prepared?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Butylic and amylic derivatives; undue amounts of water or alcohol; readily carbonizable organic impurities; methyl alcohol.
What are the use and the dose?

CHAPTER LIII

ALDEHYDE, ITS DERIVATIVES AND PREPARATIONS

The term *aldehyde,* like the terms *alcohol* and *ether,* was formerly applied to one compound. It is now used to define a class of organic bodies. The word is derived from the first syllables of the term *al*cohol *dehyd*rogenatum, which means alcohol from which hydrogen has been abstracted.

Aldehyde (*acetaldehyde*) has the composition C_2H_4O, and is made by depriving alcohol, C_2H_6O, of two hydrogen atoms. This abstraction of hydrogen may be effected by acting on ethyl alcohol with oxidizing agents, as sulphuric acid and potassium dichromate or manganese dioxide, and also in making ethyl nitrite. By the oxidation of aldehydes, acids are formed, as in making acetic acid by the beechwood shavings process (see page 985). The addition of 2H to aldehyde, C_2H_4O, reproduces alcohol, C_2H_6O, while the addition of O to aldehyde, C_2H_4O, produces acetic acid, $C_2H_4O_2$.

PARALDEHYDUM. U. S. Paraldehyde
[Paraldehyd.]

A polymer $[(CH_3CHO)_3 = 132.10]$ of acetaldehyde. Preserve it in well-closed containers, in a cool place, protected from light.

Preparation.—This official liquid is a product of the condensation of three molecules of ethyl, or ordinary aldehyde; it may be made by treating ethyl aldehyde with small quantities of either sulphur dioxide, hydrochloric acid, carbonyl chloride, or zinc chloride; almost complete conversion occurs, and by freezing the liquid and rectifying, pure paraldehyde is produced.

Official Description.—A colorless, transparent liquid.

Odor, Taste, and Reaction.—It has a strong, characteristic, but not unpleasant or pungent odor, producing first a burning and then a cooling sensation in the mouth. It is neutral or only slightly acid to moistened litmus paper.

Solubility.—One mil of Paraldehyde dissolves in 8 mils of water at 25° C. (77° F.); also in 17 mils of boiling water; miscible with alcohol, chloroform, ether, or volatile oils.

Specific Gravity.—About 0.990 at 25° C. (77° F.).

Tests for Identity.—It boils between 120° and 125° C. (248° and 257° F.).

Congealing point: not below 6° C. (42.8° F.).

When heated with a small portion of sulphuric acid, Paraldehyde is converted into acetaldehyde, recognizable by its odor.

Impurities and Tests for Impurities.—*Impurities Derived from Fusel Oil.*—Heat 5 mils of Paraldehyde on a water bath; no disagreeable odor is noticeable as the last portions evaporate and not more than 0.0025 Gm. of residue remains.

Amyl Alcohol.—One mil of Paraldehyde forms a clear solution free from oily drops with 10 mils of distilled water.

Sulphuric Acid.—and 5-mil portions of this solution, tested separately, when acidulated with nitric acid, yield no turbidity on the addition of a few drops of barium chloride T.S.

Hydrochloric Acid.—nor an opalescence with a few drops of silver nitrate T.S.

Free Acid.—A mixture of 8 mils of Paraldehyde and 8 mils of alcohol with 1 drop of phenolphthalein T.S. acquires a pink color upon the addition of 0.5 mil of normal potassium hydroxide V.S.

Acetaldehyde.—Shake 5 mils of Paraldehyde with 5 mils of potassium hydroxide T.S.; the aqueous layer is not colored yellow or brown within one hour.

Uses.—Paraldehyde is an hypnotic and a sedative. Owing to its unpleasant taste, it is usually prescribed in combination with alcoholic liquors, elixirs, etc. Dose, thirty minims to one fluidrachm (2 to 4 mils).

LIQUOR FORMALDEHYDI. U. S. Solution of Formaldehyde
[Liq. Formaldehyd.]

An aqueous solution containing not less than 37 per cent. by weight of CH_2O or H.CHO (30.02), with varying amounts of methyl alcohol to prevent polymerization. Preserve it in a moderately warm place protected from light.

Preparation.—This liquid, commonly known as *Formaldehyde*, is made by mixing the vapor of boiling methyl alcohol, which is under pressure, with air in proper quantity, and allowing the mixed vapors to pass over heated copper tubes, and then condensing the vapors by passing them into a copper tank provided with the means for cooling the temperature to 0° C. (32° F.). Sufficient water is added to the product to make it contain 37 per cent. by weight of absolute formaldehyde.

Official Description.—A clear, colorless or nearly colorless liquid. Its vapor acts as an irritant upon mucous membrane.

Odor, Taste, and Reaction.—It has a pungent odor and a caustic taste.

Solubility.—It is miscible with water or alcohol. On long standing, especially in the cold, Solution of Formaldehyde sometimes loses its transparency, the cloudiness being due to the separation of paraformaldehyde.

Tests for Identity.—Dilute 5 mils of Solution of Formaldehyde with 25 mils of distilled water and add 3 mils of silver ammonium nitrate T.S.; metallic silver is produced either in the form of a finely divided gray precipitate or as a bright metallic mirror adhering to the sides of the test tube.

Add 2 drops of Solution of Formaldehyde to 5 mils of sulphuric acid in which a little salicylic acid has been dissolved, and warm the liquid very gently; a permanent deep red color appears.

Tests for Impurities.—*Free Acids.*—Not more than 1 mil of normal potassium hydroxide V.S. is required to neutralize 20 mils of Solution of Formaldehyde, to which 2 drops of phenolphthalein T.S. have been added.

Assay.—Transfer 3 mils of Solution of Formaldehyde to a tared flask containing 10 mils of distilled water, tightly stopper and weigh accurately. Add to the contents of the flask 50 mils of normal potassium hydroxide V.S., and follow this immediately but slowly through a small funnel with 50 mils of solution of hydrogen dioxide which has previously been rendered neutral to litmus with potassium hydroxide. Now heat the mixture cautiously on a water bath for five minutes, shaking occasionally during this time; allow the mixture to cool, rinse the funnel and sides of the flask with distilled water, and after allowing it to stand thirty minutes, titrate with normal sulphuric acid V.S., using litmus T.S. as indicator. It shows not less than 37 per cent. of CH_2O, correction being made for free acid if present. Each mil of normal potassium hydroxide V.S. corresponds to 0.03002 Gm. of CH_2O. Each gramme of Solution of Formaldehyde corresponds to not less than 12.3 mils of normal potassium hydroxide V.S.

Uses.—This liquid (sometimes called *Formalin*), has been very extensively used as an antiseptic and antiferment, for preserving milk, meat, and, in fact, nearly every article of food likely to spoil through fermentation, but now National and State laws prohibit its use in this manner. It is, however, used for disinfecting apartments which have been subjected to infection by spraying it on sheets hung in the room, or the vapor may be conducted into the room from a generator of which there are numerous forms on the market. It has been shown that the internal administration of preparations containing it is not without danger.

PARAFORMALDEHYDUM. U. S. Paraformaldehyde

[**Paraform.**—PARAFORM TRIOXYMETHYLENE]

It contains not less than 95 per cent. of $(HCHO)_3$ (90.05), a polymeric form of formaldehyde. Preserve it in well-closed containers in a cool place, protected from light.

Preparation.—It is prepared by evaporating an aqueous solution of formaldehyde until it polymerizes in white masses.

Official Description.—It occurs in white, friable masses, or as a powder.

Odor.—It has a slight odor of formaldehyde.

Solubility.—It is slowly soluble in cold water, more readily soluble in hot water with the formation of formaldehyde; insoluble in alcohol or ether; soluble in fixed alkali solutions.

Tests for Identity.—On heating it is partly converted into formaldehyde and partly sublimed unchanged. A mixture of about 0.01 Gm. each of Paraformaldehyde and morphine sulphate and 10 drops of sulphuric acid assumes a violet-red color, changing to blue.

Impurities and Tests for Impurities.—Incinerate about 2 Gm. of Paraformaldehyde; not more than 0.1 per cent. of ash remains.

Shake about 0.5 Gm. of Paraformaldehyde, finely powdered, with 10 mils of distilled water; the latter remains neutral to litmus.

Assay.—Mix about 1 Gm. of Paraformaldehyde, finely powdered and accurately weighed, with 50 mils of normal potassium hydroxide V.S. in a 250-mil flask, and add immediately, but slowly, through a small funnel, 50 mils of solution of hydrogen dioxide which has been previously rendered neutral to litmus with sodium hydroxide. When the reaction has ceased and the foam subsided, rinse the funnel and the sides of the flask with distilled water, allow the liquid to stand for half an hour and then determine the excess of alkali with normal sulphuric acid V.S., using litmus T.S. as indicator. It shows not less than 95 per cent. of $(HCHO)_3$. Each mil of normal potassium hydroxide V.S. corresponds to 0.03002 Gm. of $(HCHO)_3$. Each gramme of Paraformaldehyde corresponds to not less than 31.6 mils of normal potassium hydroxide V.S.

Uses.—It is an antiseptic and escharotic; its internal use is inadvisable since it has produced serious results. The official dose is eight grains (0.5 Gm.). It is chiefly used for the generation of formaldehyde, by heating in an open pan, by a direct flame.

HEXAMETHYLENAMINA. U. S. Hexamethylenamine

[**Hexam.**—HEXAMETHYLENE-TETRAMINE]

A condensation product of ammonia and formaldehyde, hexamethylene-tetramine $[(CH_2)_6N_4 = 140.14]$. Preserve it in well-closed containers.

Preparation—Made by passing a current of dry ammonia gas over warm trioxymthylene (paraformaldehyde) and purifying the product.

Official Description.—It occurs in colorless, lustrous crystals, or as a white, crystalline powder.

Odor and Reaction.—Odorless. Its aqueous solution is alkaline to litmus.

Solubility.—One Gm. of Hexamethylenamine dissolves in 1.5 mils of water, 12.5 mils of alcohol and in 320 mils of ether at 25° C. (77° F.); soluble in chloroform.

Tests for Identity.—At about 263° C. (505.4° F.) it sublimes without melting and with partial decomposition, emitting a disagreeable odor.

Heat an aqueous solution (1 in 10) with diluted sulphuric acid; it decomposes with the liberation of formaldehyde (recognized by its odor or by its darkening paper moistened with silver ammonium nitrate T.S.).

When an aqueous solution (1 in 10) is heated with diluted sulphuric acid and then supersaturated with solution of sodium hydroxide, ammonia is liberated.

Impurities and Tests for Impurities.—Incinerate 2 Gm. of Hexamethylenamine; not more than 0.05 per cent. of ash remains.

Heavy Metals.—An aqueous solution of Hexamethylenamine (1 in 50) does not become colored or turbid when mixed with an equal volume of hydrogen sulphide T.S.

Sulphate.—Separate portions of 10 mils each of an aqueous solution of Hexamethylenamine (1 in 50), acidulated with 5 drops of nitric acid, are not rendered turbid by a few drops of barium chloride T.S.

Chloride.—nor more than slightly opalescent by a few drops of silver nitrate T.S.

Ammonium Salts.—Add 1 mil of alkaline mercuric potassium iodide T.S. to 10 mils of an aqueous solution of Hexamethylenamine (1 in 20); no other color is produced than that which results from the addition of the same amount of the reagent to 10 mils of distilled water.

Uses.—Hexamethylenamine or *urotropine* is used as a solvent for uric acid, and in the treatment of urinary affections. It is given in doses of from four to fifteen grains (0.25 to 1 Gm.).

A tablet of Hexamethylenamine may be conveniently used as a source of heat at the bedside or under other conditions where ordinary means of heating are not available. It may be ignited by a burning match and burns with a practically smokeless flame.

CHLORALUM HYDRATUM. U. S. Hydrated Chloral

[Chloral. Hydrat.—"CHLORAL" CHLORAL HYDRATE]

A compound of trichloraldehyde or chloral, with the elements of one molecule of water. It contains not less than 99.5 per cent. of $C_2HCl_3O + H_2O$ or $CCl_3.COH + H_2O$ (165.4). Preserve it in tightly stoppered bottles, in a cool place, protected from light.

Preparation.—This valuable compound is made by passing dry chlorine gas, in a continuous stream, through absolute alcohol for six or eight weeks. The chlorine is led into cold alcohol at first, and when no more is absorbed, the alcohol is heated at first gently and then to 60° C. (140° F.). When saturated, the mixture formed is agitated with sulphuric acid at a temperature of 60° C. (140° F.) for several hours, during which time most of the hydrochloric acid escapes. The separated chloral is then rectified over calcium carbonate. This is anhydrous chloral, a colorless liquid, of a penetrating odor, of the specific gravity 1.502. The pure chloral so obtained is then mixed in glass flasks with the necessary amount of water, and the resulting hydrated chloral either cast into cakes or purified by crystallization. As solvents for this purpose, certain of the side products of the chloral manufacture, after being purified and rectified, are used—for instance, ethylene and ethylidene chloride; or, in their absence, chloroform, petroleum benzin, or carbon disulphide may be employed. The name *chloral* is derived from the first two syllables of *chlor*ine and *al*cohol.

The reaction may be thus expressed:

$$\underset{\text{Alcohol}}{C_2H_4H_2O} + \underset{\text{Chlorine}}{2Cl} = \underset{\text{Acetaldehyde}}{C_2H_4O} + \underset{\substack{\text{Hydrochloric}\\ \text{Acid}}}{2HCl}$$

then

$$\underset{\text{Acetaldehyde}}{C_2H_4O} + \underset{\text{Chlorine}}{6Cl} = \underset{\text{Chloral}}{C_2HCl_3O} + \underset{\substack{\text{Hydrochloric}\\ \text{Acid}}}{3HCl}$$

Chloral is thus seen to be acetaldehyde in which three of the atoms of hydrogen have been replaced by three atoms of chlorine; hence it is termed, in systematic nomenclature, *trichloraldehyde*.

Official Description.—It occurs in rhomboidal, colorless, transparent crystals which do not readily attract moisture. It is slowly volatilized when exposed to the air.

Odor and Taste.—It has an aromatic, penetrating, and slightly acrid odor, and a bitterish, caustic taste.

Solubility.—One Gm. of Hydrated Chloral dissolves in 0.25 mil of water, 1.3 mils of alcohol, 2 mils of chloroform, and in 1.5 mils of ether at 25° C. (77° F.); very soluble in olive oil, freely soluble in oil of turpentine.

Tests for Identity.—Hydrated Chloral is decomposed by caustic alkalies, alkaline earths, and ammonia, chloroform and a formate of the base being produced. When warmed with a few drops of aniline and sodium hydroxide T.S., the intensely disagreeable odor of phenylisocyanide is produced.

Impurities and Tests for Impurities.—Gently ignite 2 Gm. of Hydrated Chloral; no inflammable vapors are evolved (distinction from *chloral alcoholate and ethyl carbamate*). On complete incineration not more than 0.05 per cent. of ash remains.

Hydrochloric Acid and Chlorides.—Ten mils of an alcoholic solution of Hydrated Chloral (1 in 20) does not at once redden moistened blue litmus paper, nor at once become opalescent on the addition of a few drops of silver nitrate T.S.

Organic Impurities.—Shake about 0.5 Gm. of Hydrated Chloral, at intervals of five minutes during one hour, with 5 mils of sulphuric acid in a glass-stoppered tube, which has previously been rinsed with sulphuric acid. The acid remains colorless, or very nearly so when viewed transversely in a tube of about 20 mm. diameter.

Assay.—Dissolve about 4 Gm. of Hydrated Chloral, accurately weighed, in 10 mils of distilled water, add 30 mils of normal potassium hydroxide V.S., and allow the mixture to stand two minutes; then add phenolphthalein T.S., and determine the residual alkali at once by titration with normal sulphuric acid V.S. It shows not less than 99.5 per cent. of $C_2HCl_3O+H_2O$. Each mil of normal potassium hydroxide V.S. consumed corresponds to 0.1654 Gm. of $C_2HCl_3O\mp H_2O$. Each gramme of Hydrated Chloral corresponds to not less than 6.02 mils of normal potassium hydroxide V.S.

Uses.—Hydrated chloral is an hypnotic. It is generally administered in a flavored syrup. Although hydrated chloral is freely soluble in alcohol, the latter is not a suitable solvent, because its therapeutic action is contraindicated: hydrated chloral should not be prescribed with alkalies or alkaline salts on account of decomposition of the hydrated chloral. Dose, eight to thirty grains (0.5 to 2 Gm.).

CHLORAL CAMPHORATUM. N. F. Camphorated Chloral

[Chloral Camph.]

	Metric	Old form
Hydrated Chloral	50 Gm.	1 oz. av.
Camphor	50 Gm.	1 oz. av.
To make	100 Gm.	2 oz. av.

Place the camphor and hydrated chloral in a suitable bottle. Stopper the bottle and warm it in a water bath, with frequent agitation, until the mixture is liquefied.

Uses.—It is used as a local anodyne.

CHLOROFORMUM. U. S. Chloroform

[Chlorof.]

A liquid consisting of not less than 99 per cent. nor more than 99.4 per cent., by weight, of $CHCl_3$ (119.39), and not less than 0.6 per cent. nor more than 1 per cent. of alcohol. Preserve it in well-stoppered bottles, in a cool place, protected from light. CAUTION: Care should be used in vaporizing Chloroform in the presence of a naked flame, as noxious gases are produced.

Preparation.—Chloroform was formerly made by mixing six parts of chlorinated lime with twenty-five parts of water, and, after transferring the mixture to a still, adding one part of alcohol. Heat is applied, and when the temperature of 40° C. (104° F.) is reached, chloroform containing some alcohol begins to distil over. This is washed with water to separate the alcohol, and the heavy liquid is further purified by redistillation.

Chloroform, $CHCl_3$, is termed chemically *trichlormethane*, because it can be produced by substituting three atoms of chlorine for three hydrogen atoms of *methane*, marsh gas, CH_4. It may also be produced by acting on hydrated chloral with an alkali; thus:

$$\underset{\text{Hydrated Chloral}}{C_2HCl_3O.H_2O} + \underset{\substack{\text{Sodium}\\\text{Hydroxide}}}{NaOH} = \underset{\text{Chloroform}}{CHCl_3} + \underset{\substack{\text{Sodium}\\\text{Formate}}}{NaCHO_2} + \underset{\text{Water}}{H_2O}$$

But chloroform is now more profitably made by reacting on acetone with chlorinated lime; the liquid products (ketones) resulting from the decomposition of crude acetates at high temperatures may also be used. The acetone must be very pure; the yield is sometimes nearly 200 per cent. The reaction is as follows:

$$\underset{\text{Acetone}}{2C_3H_6O} + \underset{\substack{\text{Calcium}\\\text{Hypochlorite}}}{6Ca(OCl)_2} = \underset{\text{Chloroform}}{2CHCl_3} + \underset{\substack{\text{Calcium}\\\text{Hydroxide}}}{2Ca(OH)_2} + \underset{\substack{\text{Calcium}\\\text{Acetate}}}{Ca(C_2H_3O_2)_2} + \underset{\substack{\text{Calcium}\\\text{Chloride}}}{3CaCl_2}$$

Absolutely pure chloroform readily decomposes upon keeping, particularly if exposed to the light, and it has long been known that the presence of a very small percentage (0.6 to 1 per cent.) of alcohol will act as a preservative.

Official Description.—A clear, colorless, mobile liquid.

Odor and Taste.—Of a characteristic, ethereal odor, and a burning, sweet taste.

Solubility.—Chloroform dissolves in 210 times its volume of water; miscible with alcohol, ether, benzene, petroleum benzin, or with fixed or volatile oils.

Specific Gravity.—1.474 to 1.478 at 25° C. (77° F.).

Tests for Identity.—Chloroform is volatile at a low temperature and boils at about 61° C. (141.8° F.). It is not inflammable, but its heated vapor burns with a green flame.

Impurities and Tests for Impurities.—Pour 20 mils of Chloroform upon a piece of clean, odorless filter paper laid flat upon a warmed glass plate, and rock the plate from side to side until the liquid is all evaporated. No foreign odor becomes perceptible as the last portions disappear from the paper, and the paper remains odorless.

Chlorides.—Agitate 10 mils of Chloroform with 25 mils of distilled water, and allow the liquids to separate completely; the aqueous layer is neutral to litmus and separate portions of 10 mils each are not affected by a few drops of silver nitrate T.S.

Free Chlorine.—nor colored blue by the addition of a few drops each of potassium iodide T.S. and starch T.S.

Impurities Decomposable by Sulphuric Acid.—Transfer 40 mils of Chloroform from the container, by means of a clean pipette, to a 50-mil glass-stoppered cylinder of colorless glass having an internal diameter of about 20 mm. and previously rinsed with sulphuric acid, add 4 mils of colorless sulphuric acid and shake the mixture vigorously during five minutes. Then allow the liquids to separate completely, so that both are transparent. The Chloroform remains colorless, and the acid is colorless or very nearly so when viewed horizontally in the cylinder held in a vertical position.

Odorous Decomposition Products.—Dilute 2 mils of the sulphuric acid, separated from the Chloroform in the preceding test, with 5 mils of distilled water; the liquid is colorless and clear, and, while hot from the mixing, emits but a faint, vinous or ethereal odor.

Chlorinated Decomposition Compounds.—When further diluted with 10 mils of distilled water, it remains clear and is not affected within one minute by the addition of 3 drops of silver nitrate T.S.

U. S. P. Preparations.—Aqua Chloroformi; Linimentum Chloroformi; Spiritus Chloroformi.

N. F. Preparations.—Elixir Ammonii Valeratis; Elixir Phosphori; Linimentum Aconiti et Chloroformi; Liquor Guttæ Perchæ; Liquor Pancreatini; Mistura Chloroformi et Morphinæ Compositæ; Mistura Olei Picis; Mistura Opii et Chloroformi Composita; Petroxolinum Chloroformi Camphoratum; Syrupus Pini Strobi Compositus; Syrupus Pini Strobi Compositus cum Morphina; Trochisci Quininæ Tannatis.

Chloroform sometimes contains chlorinated decomposition products which render it unfit for its most important use, that of an anæsthetic, and the pharmacist should assure himself that the chloroform he sells for that purpose strictly conforms to all of the tests of the U. S. P.

Uses.—Chloroform which corresponds to the official tests, or when purified, is used as an anæsthetic by inhalation. Taken internally, well diluted, in large doses, one to two fluidrachms (4 to 8 mils), it is narcotic; in small doses, five to fifteen minims (0.3 to 1 mil), it is carminative and sedative. Externally it is irritant, and may produce blisters. The caution of the U. S. P. to avoid the use of chloroform in the presence of a naked flame is for the purpose of avoiding the development of objectionable vapors which are irrespirable and acid.

It is used as a preservative in a number of preparations, such as the fluidglycerates, to prevent decomposition during the process of manufacture. In most instances it is evaporated before the product is finished.

BROMOFORMUM. U. S. Bromoform
[Bromof.]

A liquid consisting of about 96 per cent., by weight, of $CHBr_3$ (252.77) and about 4 per cent. of dehydrated alcohol. Preserve it in glass-stoppered bottles, in a cool place, protected from light.

Preparation.—Bromoform may be made by the action of bromide on alcohol in the presence of alkalies or alkali hydroxides, but it is preferably made by the reaction of sodium hypobromite upon acetone, just as chloroform is made by the "acetone process" (see page 1080); sodium acetate and sodium hydroxide are by-products.

Official Description.—A heavy, transparent, colorless, mobile liquid.

Odor and Taste.—It has an ethereal odor, and a penetrating, sweet taste, resembling that of chloroform.

Solubility.—Bromoform is slightly soluble in water; miscible with alcohol, chloroform, ether, benzene, petroleum benzin or fixed or volatile oils.

Specific Gravity.—2.595 to 2.620 at 25° C. (77° F.).

Tests for Identity.—Bromoform is slightly volatile at ordinary temperatures.

Bromoform is not inflammable, but when vaporized by the application of heat, its vapors may be ignited.

Impurities and Tests for Impurities.—Evaporate 10 mils of Bromoform from a porcelain dish on a water bath; not more than 0.006 Gm. of residue remains after drying it at 100° C. (212° F.).

Shake 10 mils of Bromoform with 10 mils of distilled water, and allow the liquids to separate completely.

Free Acid.—The water removed from the layer of Bromoform is neutral to litmus.

Bromides or Brominated Compounds.—Five mil portions, tested separately, show not more than a slight opalescence on the addition of a few drops of silver nitrate T.S.

Free Bromine.—and no blue color on the addition of a few drops each of potassium iodide T.S. and of starch T.S.

Acetone.—Agitate 10 mils of Bromoform with 10 mils of distilled water, and allow the liquids to separate completely. Remove the aqueous layer from the Bromoform, treat it with an excess of ammonia water, and then with a solution of iodine and ammonium iodide, until the black precipitate of nitrogen iodide, which sometimes forms, slowly disappears; it does not become milky in appearance, due to the separation of iodoform, recognizable by its odor.

Uses.—Care should be taken in dispensing bromoform to see that it is colorless, free from acidity, and that it conforms strictly to the official tests. It is used as a remedy in whooping cough; owing to its insolubility in water, it may be administered dissolved in alcohol in proper quantity and this solution mixed with glycerin and a flavored syrup. Dose, three minims (0.2 mil).

IODOFORMUM. U. S. Iodoform
[Iodof.]

Triiodomethane [$CHI_3 = 393.77$] usually obtained by the action of iodine upon alcohol or acetone, in the presence of an alkali or alkali carbonate. Preserve it in well-closed containers, in a cool place, protected from light.

Preparation.—Iodoform may be made by Filhol's process, which consists in heating, in a water bath, one hundred parts of alcohol, two hundred parts of potassium carbonate, and one thousand parts of distilled water, and gradually adding one hundred parts of iodine in small portions. Chlorine gas is passed through the mixture to cause the separation of the iodoform, which may be filtered out. The filtrate may be concentrated and decomposed by excess of nitric acid. The collected crystals of iodoform are now well washed with the smallest quantity of cold distilled water, spread out on pieces of bibulous paper, and dried in the open air.

$$\underset{\text{Alcohol}}{C_2H_5OH} + \underset{\text{Iodine}}{8I} + \underset{\substack{\text{Acid Potassium}\\\text{Carbonate}}}{2KHCO_3} = \underset{\substack{\text{Potassium}\\\text{Iodide}}}{2KI} + \underset{\text{Iodoform}}{2CHI_3} + \underset{\text{Water}}{3H_2O} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{2CO_2}$$

It may also be made by adding a solution of chlorinated soda, by drops, to a solution of fifty grammes of potassium iodide, five grammes of sodium hydroxide, and forty grammes of acetone in 1000 mils of water, and collecting the crystals of iodoform which separate.

It may be obtained in very fine powder by making a concentrated solution in alcohol, acetone, or one of its other solvents, and pouring this into water, collecting, washing, and drying the precipitate.

The specific gravity of iodoform, about which there has been a controversy, was determined by J. Percy Remington to be 4.000; the specific gravity of 2.000 as given in the U. S. P., 1890, was undoubtedly due to the operator taking the specific gravity of the iodoform in water, and when this is done, it is practically impossible to free the crystals from admixed air; the result was reached by using a saturated solution of iodoform in pure kerosene as the liquid, and by calculation obtaining the equivalent in water.

Official Description.—It occurs as a fine, lemon-yellow powder, or in lustrous crystals of the hexagonal system.

Odor, Taste, and Reaction.—It has a peculiar, very penetrating and persistent odor, and an unpleasant, slightly sweetish taste suggestive of iodine. Its solutions are neutral to litmus.

Solubility.—It is nearly insoluble in water, to which it, however, imparts its odor and taste. One Gm. of Iodoform dissolves in 60 mils of alcohol, 80 mils of glycerin, 10 mils of chloroform, 7.5 mils of ether, 2.8 mils of carbon disulphide, and in 34 mils of olive oil at 25° C. (77° F.); also in about 16 mils of boiling alcohol.

Tests for Identity.—Iodoform is slightly volatile, even at ordinary temperatures, and in boiling water distils slowly with the vapor of water. At about 115° C. (239° F.) it melts to a brown liquid, and at a higher temperature it decomposes, emitting vapors of iodine.

Impurities and Tests for Impurities.—Incinerate about 1 Gm. of Iodoform; not more than 0.2 per cent. of ash remains.

Dry about 1 Gm. of Iodoform, accurately weighed, for twenty-four hours over sulphuric acid; the loss in weight does not exceed 1 per cent.

Soluble Yellow Coloring Matter, Picric Acid.—Shake about 2 Gm. of Iodoform for one minute with 5 mils of distilled water and filter; the filtrate is colorless and free from bitter taste

Acids or Alkalies.—and does not affect the color of litmus.

U. S. P. Preparation.—Unguentum Iodoformi.

N. F. Preparations.—Collodium Iodoformi; Glycerogelatinum Iodoformi; Iodoformum Aromatisatum; Petroxolinum Iodoformi.

Uses.—Iodoform, when given internally, is used principally as an alterative. It is also antiseptic and a local anæsthetic. It is used very largely as an external application to wounds and ulcers. The dose is one to four grains (0.065 to 0.25 Gm.).

IODOFORMUM AROMATISATUM. N. F. Aromatized Iodoform

[Iodof. Arom.]

	Metric	Old form
Iodoform, in fine powder	**96 Gm.**	**3 oz. av. 367.5 gr.**
Coumarin, in fine powder	**4 Gm.**	**70 gr.**
To make	**100 Gm.**	**4 oz. av.**

Mix them intimately by trituration.

Uses.—The coumarin is added to partially overcome the disagreeable odor of the iodoform. It is used like iodoform.

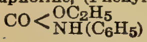
Unofficial Ethyl, Amyl, and Methyl Compounds, and Allied Products

Acetal (Diethylacetal, Diethylaldehyde, Ethylenediethyl Ether), $CH_3{-}CH(OC_2H_5)_2$	Obtained from reaction between acetaldehyde and alcohol in the presence of dehydrating agents. Soluble in 20 parts of water, and in all proportions of alcohol and ether. Used as an hypnotic in doses of two fluidrachms (8 mils)
Adalin, (Bromdiethylacetylcarbamide) $C(C_2H_5)_2Br.\ CONH.CONH_2$	An efficient sedative in conditions where a powerful hypnotic is not required. It has no unpleasant after effect. Dose five to ten grains (0.32–0.65 Gm.)
Aldehyde (Acetaldehyde), C_2H_4O	By gently warming a mixture of alcohol, manganese dioxide, sulphuric acid, and water, and collecting the vapor which is formed, by means of a condenser. If exposed, it will gradually be converted into acetic acid. It is a colorless, thin, and very inflammable liquid, having an ethereal odor, and the sp. gr. 0.805
Amyl Acetate, $C_5H_{11}.C_2H_3O_2$	By distilling amyl alcohol with an acetate and sulphuric acid. It is, when pure, a colorless liquid having a very fragrant odor. Insoluble in water. Sp. gr. 0.876. Used as a solvent
Amyl Alcohol	See reagents, Chapter LXII
Amyl Butyrate, $C_5H_{11}.C_4H_7O_2$	Sp. gr. 0.852. Fragrant odor
Amyl Chloride, $C_5H_{11}.Cl$	By the action of strong hydrochloric acid upon amylic alcohol. Sp. gr. 0.874
Amyl Iodide, $C_5H_{11}.I$	By acting upon amylic alcohol with iodine and phosphorus. It is a colorless, transparent liquid, of a faint odor and a pungent taste. Sp. gr. 1.509
Amyl Valerate, $C_5H_{11}.C_5H_9O_2$	Sp. gr. 0.864. Odor of apples. Used as a sedative and as a solvent for cholesterin. Dose, two to three grains (0.1–0.2 Gm.)
Amylene (Valerene, Pentene, Pental), $(CH_3)_2C.CH.CH_3$	A colorless liquid, having a peculiar, disagreeable odor; density, 0.655 at 10° C. (50° F.). Anæsthetic. Too dangerous for use
Amylene-Chloral Solution (50 per cent.)	Uses much like those of chloral, but less powerful. An hypnotic. Dose eight to forty-five minims (0.5–3 mils)
Amylene Hydroxide	Used as an hypnotic. Dose, one fluidrachm (4 mils)
Anesthesin $C_6H_4.N.H_2.COO(C_2H_5)$	Ethyl ester of par-amido-benzoic acid; white, odorless, tasteless powder. Soluble in alcohol, ether, chloroform, but slowly in water. Used as a local anæsthetic as a substitute for cocaine. Dose, five to ten grains (0.32 to 0.65 Gm.) twice daily
Argentamine, (Ethylene-Diamine-Silver Nitrate)	An aqueous solution of ethylene-diamine and 10 per cent. silver nitrate. Said to be non-irritating. An antiseptic and astringent like other silver salts. It is also used as a dusting powder and in ointments and suppositories. Used in 1 to 5 per cent. solution
Barium Sulphethylate, $Ba(C_2H_5SO_4)_2$	By neutralizing ethylsulphuric acid with barium carbonate, filtering off the insoluble barium sulphate, and evaporating the filtrate to crystallization
Benzosalin (Benzoyl-Salicylic-Acid-Methylester) $C_6H_4O\ (CH_3).\ CO.O.(C_6H_5CO),\ 1{:}2.$	White, acicular crystals; insoluble in water, readily soluble in alcohol. Incompatible with acids. Said to decompose in the intestines into benzoic and salicylic acids. Used in rheumatism, neuritis and neuralgia. Dose, eight to sixty grains (0.5–4.0 Gm.)
Bismal, (Bismuth Methylene-digallate) $4\ (C_{15}H_{12}O_{12}).\ 3\ Bi\ (OH)_3$	Prepared by digesting methylene digallic acid with bismuth hydroxide. Used as an astringent in chronic diarrhea in doses of two to five grains (0.13–0.32 Gm.)
Bromal, C_2HBr_3O	Hypnotic. Dose, three grains (0.2 Gm.)
Bromalin (Hexamethylene-tetramine Bromethylate) $(CH_2)_6N_4.C_2H_5Br$	Prepared by the interaction between equal parts of ethyl bromide and hexamethylene-tetramine. Used in epilepsy to replace alkaline bromides. Dose, thirty to sixty grains (2–4 Gm.)

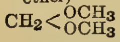
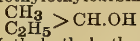
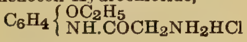
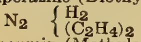
Unofficial Ethyl, Amyl, and Methyl Compounds, and Allied Products—*Continued*

Bromamide, $C_6H_2Br_3NH_2.HBr$	Prepared by reducing nitro-tribrom-benzene with tin and sulphuric acid. Antipyretic, analgesic, and antirheumatic. Dose, ten to fifteen grains (0.65 to 1 Gm.)
Bromopyrine (Monobromantipyrine), $C_{11}H_{11}BrN_2O$	In white, crystalline needles. Soluble in alcohol and chloroform. Slightly soluble in hot water
Butyl Chloral, $C_4H_5Cl_3O$, Butyl Chloral-Hydrate, (Croton Chloralhydrate), $C_4H_5Cl_3O.H_2O$	Pass chlorine into aldehyde; this compound is formed in addition to chloral. Butyl chloral is a dense, oily liquid, of peculiar odor. It dissolves when treated with an excess of warm water, and on cooling deposits *butyl chloral hydrate.* Used as an hypnotic in ten grain (0.65 Gm.) doses
Cacodylic Acid, $(CH_3)_2AsO.OH$ (Dimethylarsenic Acid)	Prepared by distilling arsenous acid and potassium acetate together and oxidizing the resulting product with mercuric oxide. Used in the form of the sodium salt in skin diseases
Calcium Sulphethylate, $Ca(C_2H_5SO_4)_2$	By neutralizing ethylsulphuric acid with calcium carbonate, filtering off the insoluble calcium sulphate, and evaporating the filtrate to crystallization
Carbonei Tetrachloridum, (Carbon Tetrachloride, Tetrachlor-Methane, Chlorocarbon, Carbonei Chloratum, CCl_4)	Anæsthetic. A colorless liquid. Sp. gr. 1.599. It is not inflammable, and is largely used as a cleaner and in fire extinguishers
Chloral Ammonium, $CCl_3CH(NH_2)OH$	Used as an hypnotic and substitute for chloral and urethane. Dose, fifteen to thirty grains (1 to 2 Gm.). Called also tri-chlor-amido-ethylic-alcohol
Chloral-amylene Hydrate, (Dermiol,) $CCl_3CHOHOC_5H_{11}$	Prepared by mixing anhydrous chloral with amylene hydrate. Used as an hypnotic. Dose, one-half to one fluidrachm (2-4 mils) of a 10 per cent. solution
Chloral Carbamide	Similar to chloral in its action, but slow and uncertain
Chloral Cyanhydrate, $CCl_3.COH.HCN$	A substitute for hydrocyanic acid. 6½ parts, by weight correspond with 1 part of anhydrous hydrocyanic acid
Chloralformamide (Chloralamide), $C_3H_4Cl_3NO_2$, U. S. P. VIII	It is an addition product of chloral, CCl_3COH, and formamide, CH(OH)NH. It is used as an hypnotic in doses of fifteen grains (1 Gm.)
Chloralimide, $CCl_3CH{-}NH$	Prepared by heating chloralamide to the temperature of boiling water, when it decomposes into chloralimide and water. Antipyretic and analgesic. Dose, three to seven grains (0.2 to 0.45 Gm.)
Chloral Menthol, (Mentholated Chloral)	An oily, colorless liquid, with a mint-like odor. Sp. gr. 1.984 Counterirritant and local anæsthetic
Chlormethylmenthyl Ester, (Forman,) $C_{10}H_{19}O.CH_2Cl$	Prepared by the action of formaldehyde on menthol in the presence of hydrochloric acid gas. Used for catarrhal affections of the respiratory passages
Chloralose, $C_8H_{11}Cl_3O_6$	Hypnotic. Dose, twelve grains (0.77 Gm.)
Chloral Phenol	Prepared by triturating equal parts of phenol and chloral hydrate together. Used as an hypnotic, locally as a counterirritant and anæsthetic
Chloral Urethane (Uralium), $CCl_3CH\left\{\begin{matrix}OH\\NHCO_2C_2H_5\end{matrix}\right.$	Hypnotic. Dose, fifteen grains (1 Gm.)
Copper Sulphethylate, $Cu(C_2H_5SO_4)_2$	By mixing alcoholic solutions of ethyl sulphydrate and copper acetate and collecting the gelatinous precipitate
Cumene, (Trimethylbenzene,) $C_6H_3(CH_3)_3$	A colorless liquid obtained from coal tar and used for sterilizing catgut
Diethylbarbituric Acid, Veronal	Hypnotic. Dose, five to fifteen grains (0.32-1.0 Gm.)
Ethyl Benzoate, $C_2H_5.C_7H_5O$	By heating to 100° C. (212° F.) in a sealed glass tube a mixture of alcohol and benzoic acid. It is a colorless, oily liquid with a pleasant aromatic smell and a pugent taste. Sp. gr. 1.051
Ethyl Bromide, C_2H_5Br	By mixing amorphous phosphorus with absolute alcohol, and adding bromine gradually, then distilling carefully, and washing with a small quantity of solution of sodium hydroxide to remove any free bromine. A transparent and colorless liquid. Sp. gr. 1.40. Very volatile. It has a strong ethereal odor and a pungent taste
Ethyl Butyrate, $C_2H_5.C_4H_7O_2$	By heating together a mixture of strong sulphuric acid, butyric acid, and strong alcohol. A transparent, colorless, very thin liquid. It has an odor resembling that of pineapple. Sp. gr. 0.902
Ethyl Cyanide (Hydrocyanic Ether, Propionitrile,) C_3H_5N, or $C_2H_5.CN$	A colorless liquid. Sp. gr. 0.78. Very poisonous, but less so than hydrocyanic acid, with which it agrees in therapeutic action and dose
Ethyl Disulphide, C_2H_5S	By acting upon potassium disulphide in concentrated solution with potassium sulphethylate. A colorless, oily liquid, having a very strong odor and a sharp, sweetish taste
Ethyl Formate, (Formic Ether) $C_2H_5CHO_2$	Prepared by distilling sodium formate, alcohol and strong sulphuric acid together. Causes muscular relaxation and anæsthesia when inhaled
Ethyl Iodide, C_2H_5I	By acting upon alcohol with iodine and phosphorus. A colorless, volatile liquid, but gradually turning brown in the light. Slightly soluble in water. Sp. gr. 1.946. Anæsthetic, antispasmodic, and stimulant. Dose fifteen drops three or four times a day, inhaled from a handkerchief

Unofficial Ethyl, Amyl, and Methyl Compounds, and Allied Products—*Continued*

Ethyl Pelargonate (Grape Oil), $C_2H_5.C_9H_{17}O_2$	By adding sulphuric acid and water to wine lees, and distilling in a current of steam. A colorless, mobile liquid, of a strong vinous odor. Almost insoluble in water, but soluble in alcohol. Sp. gr. 0.860
Ethylproprionyl, (Diethylketone) $C_5H_{10}O$	Prepared by the dry distillation of calcium proprionate, it can also be prepared by distilling sugar with an excess of lime. Hypnotic. Dose, eight to forty-five minims (0.5-3 mils) largely diluted
Ethyl Salicylate, $C_6H_4.OH.CO.O.(C_2H_5)$	Analogous to methyl salicylate, has the same action but less irritating and toxic. Dose, five to ten minims (0.3–0.6 mils)
Ethyl Sulphydrate (Mercaptan), $C_2H_5.HS$	By distilling crystallized calcium sulphethylate with a solution of barium sulphydrate, collecting the product in a well-cooled receiver, then decanting the aqueous portion and purifying the mercaptan by distilling with mercury and dehydrating by calcium chloride. A colorless, very mobile liquid, having an alliaceous odor
Ethylsulphuric Acid (Sulphovinic Acid), $C_2H_5.HSO_4$	By reacting upon sulphuric acid with alcohol. It is produced during the preparation of ether
Ethyl Valerate, $C_2H_5.C_5H_9O_2$	A colorless liquid having a fruity odor, andalso one like that of valerian. Sp. gr. 0.866. It is also called ethyl valerianate
Ethylene Bromide, $C_2H_4.Br_2$	Contains 90.9 per cent. of bromine. Dose, six drops three times a day. Used in epilepsy
Ethylene Diamine, $C_2H_4(NH_2)_2$	Prepared by heating ethylene bromide with an excess of alcoholic ammonia, filtering, evaporating to dryness and distilling the residue with potassium hydroxide. Used as a solvent for the false membrane in diphtheria in 2 per cent. solution
Ethylidene Chloride, (Aran's Ether, Wigger's Ether, Ethydene-Chloride,) CH_3CHCl_2	A colorless liquid, somewhat resembling chloroform. Sp. gr. 1.175 at 17° C. (62.6° F.); boiling at 60° C. (140° F.). Anæsthetic
Eucodin, (Methyl-Codeine Bromide) $C_{18}H_{21}O_3N(CH_3)Br$	Used as a sedative as a substitute for codeine, especially in cough. Dose, one grain (0.065 Gm.)
Eugoform (Acetylized Methylene Diguaiacol)	Prepared from guaiacol by the action of formaldehyde and acetylization. Used as an antiseptic in form of a dusting powder and ointment
Eumydrin (Methylatropine)	Prepared by the treatment of methyl atropine with nitric acid. Used as a mydriatic, internally as an antihidrotic in doses of one-sixtieth to one-twenty-fourth grain (0.001-0.0025 Gm.)
Euphorine, (Phenyl Urethane),  $CO<^{OC_2H_5}_{NH(C_6H_5)}$	Prepared by the interaction of aniline and ethyl chloroformate purified by recrystallization from diluted alcohol. Antipyretic, antiseptic, antirheumatic, and analgesic. Dose, eight grains (0.5 Gm.), equivalent to fifteen grains (1 Gm.) of antipyrine
Euphthalmine (Phenylglycoll-N-Methyl-β-Vinyl-Diacetonalkamine)	Prepared by methylating vinyldialkamine and treating the resulting compound with a very dilute solution of mandelic acid. Used as an active mydriatic in from 2 to 10 per cent. solutions
Eupyrine (Vanillin-Ethyl-carbonate-para-Phenetidin)	A non-toxic antipyretic especially useful for debilitated and old persons. Dose, fifteen to thirty grains (1-2 Gm.)
Exalgine (Methylacetanilid) $C_6H_5N(CH_3)CH_3CO$, or $C_9H_{11}NO$	Antipyretic, analgesic, and antispasmodic. Dose, three to six grains (0.2 to 0.38 Gm.), not more than twelve grains being given in twenty-four hours
Formanilide, $C_6H_5NH.COH$	Colorless crystals, readily soluble in water, alcohol, glycerin, and oils. Used as an antipyretic and analgesic in two to five grain (0.13 to 0.32 Gm.) doses. A local anæsthetic, in 3 per cent. solution, in subcutaneous injection
Guaiacol-Ethyl (Guetol) $C_6H_4.OC_2H_5.OH$	Used as an antitubercular in pill or solution. Dose, two to eight grains (0.13-0.5 Gm.)
Guaialin (Methylene Diguaiacol-Benzoic ester)	An antipyretic and alterative tonic in tubercular affections
Guaiasanol (Diethylglycocoll-Guaiacol Hydrochloride)	Small colorless, prismatic crystals. Used as an antiseptic and anæsthetic in the treatment of intestinal and pulmonary tuberculosis. Dose, fifteen to forty-five grains (1-3 Gm.)
Hedonal (Methyl-propyl-Carbinol Urethane)	Used as an hypnotic in treatment of insomnia due to mental overwork. Dose, fifteen to thirty grains (1-2 Gm.)
Helmitol (Hexamethylene-tetramine-anhydro-methylene-citrate)	Colorless crystals, soluble in 15 parts of water, slowly soluble in alcohol. Used as a urinary antiseptic in doses of fifteen grains (1 Gm.)
Hetralin (Hexamethylene-tetramine, Resorcinol), $C_6H_6O_2(CH_2)_6N_4$	White needle shaped crystals. Used in the treatment of gonorrhœa, cystitis, etc. Dose, fifteen to thirty grains (1–2 Gm.)
Iodal, $CI_3.COH$	Made by the action of iodine on alcohol and nitric acid. It resembles chloral in its therapeutic action
Iodo-gallicin (Bismuth oxyiodo-methyl-gallol)	Prepared by the action of bismuth oxyiodide on methylgallate. Used as a substitute for iodoform
Iodol, $C_4I_4N.H$, U.S.P. VIII	By dissolving pyrrol and iodine in alcohol, allowing it to stand 24 hours and precipitating with water. It is used as an antiseptic dressing to wounds
Kryofin (Methylglycollicphenetidin)	Colorless, crystalline needles, soluble in alcohol, ether and chloroform
Menthiodol	Prepared by carefully heating 4 parts of menthol in a capsule, adding 1 part of finely powdered iodol, and triturating into a homogeneous mass. Used as a local application in neuralgia

Unofficial Ethyl, Amyl, and Methyl Compounds, and Allied Products—*Continued*

Mesotan, $C_9H_{10}O_4$	Prepared by the action of chlormethyl ether on salicylates. A clear, yellowish, faintly aromatic liquid. Used, when diluted with olive oil, in treatment of rheumatism
Methacetin (Para-acetanisidine, Paraoxymethylacetanilid), $C_6H_4(OCH_3).NHC_2H_3O$	Preparation identical with that of acetphenetidin, except that methyl iodide or chloride is used in place of the respective ethyl compound. Antipyretic, analgesic, antirheumatic. Dose, eight grains (0.5 Gm.)
Methyl Acetate, $CH_3.C_2H_3O_2$	Prepared by processes similar to those employed for obtaining ethyl acetate, *quod bide.* It is present to some extent in crude wood naphtha. Sp. gr. 0.919. Readily soluble in water
Methyl Alcohol	See reagents Chap. LXII
Methyl Chloride, CH_3Cl	By distilling together a mixture of methyl alcohol, sodium chloride, and sulphuric acid. It is a gas at ordinary temperatures, but may be condensed by pressure to a colorless, very mobile liquid. It has an ethereal odor and a sweet taste. Used chiefly as a local anæsthetic
Methyl Iodide, CH_3I	By distilling 1 part phosphorus, 8 parts iodine, and 12 parts methyl alcohol, allowing the distillate to pass into a bottle containing water, then rectifying the product in a water-bath over calcium chloride and lead oxide. A colorless liquid. Sp. gr. 2.23. Vesicant. It is best applied on lint
Methyl Amino-oxybenzoate (Orthoform New) $C_6H_3.NH_2.OH.CO.O.(CH_3)$	Used as a local anæsthetic, resembling cocaine in its action Dose, eight to fifteen grains (0.5-1.0 Gm.)
Methylal (Methylene-dimethyl ether)  $CH_2<\begin{matrix}OCH_3\\OCH_3\end{matrix}$	Prepared by distilling a mixture of methyl alcohol, sulphuric acid and manganese dioxide. A colorless liquid, easily soluble in water, in alcohol, in fatty and in ethereal oils. Used as an hypnotic. Dose, seventy-five to one hundred grains (5.0 to 6.5 Gm.)
Methylene Dichloride (Dichloromethane, Bichloride of Methylene) CH_2Cl_2	A colorles sliquid (sp. gr. 1.344), having an odor analogous to that of chloroform. Anæsthetic. Given internally in the dose of ten to thirty minims (0.6 to 2 mils)
Methylenedicotoin, Fortoin $CH_2(C_{14}H_{11}O_4)_2$	A condensation product of cotoin and formaldehyde obtained by means of a dehydrating agent. Used as an antiseptic astringent in doses of four grains (0.25 Gm.) three times daily
Methylethylcarbinol;  $\begin{matrix}CH_3\\C_2H_5\end{matrix}>CH.OH$	Antipyretic. Isomeric with trimethylcarbinol
Methyl-ethyl-ether, $CH_3C_2H_5O$	Prepared by the action of ethyl iodide upon sodium methylate. These substances are caused to react in a retort and passed through a solution of sodium hydroxide and cooled. Its use as an anæsthetic is limited
Methylic Ether (Oxide of Methyl) $(CH_3)_2O$	Anæsthetic
Neuronal (Bromodiethylacetamide), $C_6H_{13}BrNO$	Hypnotic. Dose, eight to fifteen grains (0.5-1.0 Gm.)
Orcin (Methylresorcinol) $C_7H_8O_2+H_2O$	An antiseptic used like resorcinol in skin diseases
Pentane (Amylhydride), $CH_3.CH_2.CH_2.CH_2.CH_3$	A colorless, volatile liquid (sp. gr. 0.626), very inflammable. Proposed as an anæsthetic
Phenocoll Hydrochloride,  $C_6H_4\left\{\begin{matrix}OC_2H_5\\NH.COCH_2NH_2HCl\end{matrix}\right.$	Prepared by the action of chloracetyl chloride on phenetidin and treating with ammonia, then neutralized with hydrochloric acid. Antipyretic, antirheumatic. Dose, eight to twelve grains (0.5 to 0.77 Gm.)
Piperazine (Diethylendiamine),  $N_2\left\{\begin{matrix}H_2\\(C_2H_4)_2\end{matrix}\right.$	Antirheumatic and solvent of uric acid. Dose, fifteen grains (1 Gm.) during the day
Pneumin (Methylenecreosote)	Obtained as a condensation product by the action of formaldehyde on creosote. A yellowish, odorless, tasteless powder. Used in treatment of tuberculosis and pulmonary catarrh. Dose, eight grains (0.5 Gm.)
Potassium Ethylate, C_2H_5KO	By treating absolute alcohol with potassium. It crystallizes in colorless crystals
Potassium Sulphethylate, $KC_2H_5SO_4$	By acting upon mercaptan with potassium. It is a dull white, granular mass, very soluble in water
Pyramidon (Dimethylamine-Antipyrine), $C_{13}H_{17}N_3O$	Prepared by reducing an acetic acid solution of nitroso-antipyrine in alcohol to amido-antipyrine and treating with methyl chloride or iodide. An antipyretic and analgesic in treatment of rheumatism. Dose, five to eight grains (0.32-0.5 Gm.)
Silver Sulphethylate, $AgC_2H_5SO_4$	By adding silver nitrate to an aqueous solution of mercaptan and collecting the white precipitate
Sodium Ethylate, C_2H_5NaO	By treating absolute alcohol with sodium. It crystallizes in broad laminæ. Used in 10 per cent. solution in the treatment of skin diseases
Somnal, $C_7H_{12}Cl_3O_3N$	A compound of chloral, alcohol, and urethane forming a clear, colorless liquid of a burning taste. Used as an hypnotic. Dose, from one-half to one drachm (2 to 4 Gm.)
Sozal (Aluminum Paraphenolsulphonate), $(C_6H_4(OH)SO_3)_3Al$	Antiseptic. Used in a 1 per cent. solution as a wash
Soziodol (Diiodparaphenol-sulphonic Acid), $C_6H_2I_2(SO_3H)OH$	Bactericide. Used as a dusting powder and as a wash in 3 per cent. solution

Unofficial Ethyl, Amyl, and Methyl Compounds, and Allied Products—*Continued*

Stovain (Benzoyl-dimethyl aminopropanol hydrochloride)	Small brilliant scales or a white crystalline powder. It is stable and its solutions may be sterilized at 115° C. (239° F.) without suffering decomposition. Used as a local anæsthetic having about the same power as cocaine. It is one-half as toxic as cocaine. Dose one-thirtieth grain (0.002 Gm.)
Sulphaminol (Thioxydiphenylamine), $C_{12}H_9S_2NO$	Used as a substitute for iodoform. The dose is four grains (0.25 Gm.). Externally, it may be used in powder or in oily mixtures
Tannoform (Methyleneditannin), $CH_2(C_{14}H_9O_9)_2$	Prepared by mixing solutions of formaldehyde and tannic acid, precipitating with concentrated hydrochloric acid, washing and drying. Used as an astringent dusting powder in cases of excessive sweating
Tetronal, $(C_2H_5)_2.C.(SO_2C_2H_5)_2$	Sedative hypnotic. Dose, fifteen to thirty grains (1 to 2 Gm).
Thymacetin, $C_6H_2.CH_3.C_3H_7\left\{\begin{matrix}OC_2H_5\\NH(C_2H_3O)\end{matrix}\right.$	Antiseptic, analgesic, and hypnotic. Dose, three to fifteen grains (0.2 to 1 Gm.)
Trimethylamine (Propylamine), $N(CH_3)_3$	The chloride is usually preferred for internal use. Dose, seven to twenty grains (0.45 to 1.3 Gm.)
Urasol (Acetyl-methylene-disalicylic acid)	Prepared from 75 parts salicylic acid, 16 parts acetic acid and 8 parts formaldehyde. Used in the treatment of muscular rheumatism, gout, and cystitis in doses of five to eight grains (0.32-0.5 Gm.)
Valyl (Valeryldiethylamide) $C_4H_9CON(C_2H_5)_2$	Prepared by the interaction of valeric acid and diethylamine, Used as a sedative and antispasmodic in hysteria. Dose, two grains (0.13 Gm.) in capsules

QUESTIONS ON ALDEHYDE, ITS DERIVATIVES AND PREPARATIONS

What is meant by the term aldehyde? (See page 1075.) What is the derivation of the word?

What is its chemical composition?

What is produced when two hydrogen atoms are added to aldehyde? What is the dose?

Paraldehyde—Give Latin name, formula in symbols, and molecular weight.

How is it made? Describe appearance, odor, taste, chemical reaction, and solubility. What is the specific gravity? Give the tests for identity.

How may the following impurities be detected?—Fusel oil derivatives; amyl alcohol; hydrochloric acid; free acid; sulphuric acid; acetaldehyde.

What are its uses and dose?

Solution of formaldehyde—What is the Latin title? What percentage of absolute formaldehyde should this solution contain? How is it made?

Describe appearance, odor, taste, chemical reaction, and solubility. What are the tests for identity?

How may free acid be detected?

Describe the assay process.

For what is it used?

Paraformaldehyde—What is the Latin title? Give the common synonyms. What is the official definition?

How may it be prepared?

Describe its appearance, odor, solubility and tests for identity.

What impurities are likely to be present and how may they be detected?

What are its uses and the dose?

Hexamethylenamine—Give the Latin title, chemical formula in symbols, and chemical name.

How is it made?

Describe appearance, odor, chemical reaction, and solubility. Give the tests for identity.

By what common name is it known?

For what is it used? Give the dose.

Hydrated chloral—Give Latin name, formula in symbols and synonyms.

Give the U. S. P. definition.

How is it made?

What is the difference in composition between chloral and aldehyde?

Hence, what is its name in systematic nomenclature?

Describe its appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—Hydrochloric acid; chlorides; organic impurities.

What are its uses and the dose?
Chloroform—What is the Latin name?
Give formula in symbols. What percentage of absolute chloroform should it contain? What precautions should be taken in using it and why? How is it made?
What is the object of this process, and how does it act?
What is it termed chemically, and why?
What is the reaction when it is produced by acting on hydrated chloral with an alkali?
What are the reactions occurring when it is made from alcohol and chlorinated lime?
Describe appearance; odor, taste, chemical reaction, and solubility.
What are the identity tests?
How may the following impurities be detected?—Foreign odors; chlorides; free chlorine; impurities decomposable by sulphuric acid; odorous decomposition products; chlorinated dcomposition products.
By what process may it be purified?
What are its uses in medicine and pharmacy? What is the dose?
What are its official preparations?
Bromoform—Give the Latin title and chemical formula in symbols.
What percentage of absolute bromoform should it contain? How may it be made?
Describe appearance, odor, taste, and solubility. What is the specific gravity? Give tests for identity.
How may the following impurities be detected?—Free acid; bromides or bromated compounds; free bromine; acetone.
For what is it used? In what dose?
Iodoform—What is the Latin name?
Give the formula in symbols.
How may it be made by Filhol's process?
Describe appearance, odor, taste, chemical reaction, and solubility. What are the tests for its identity? What is the dose?
How may the following impurities be detected?—Fixed impurities; soluble yellow coloring matter, picric acid; acids; alkalies.
For what is it used in medicine?
What is the dose? What preparation of it is official?
Aromatized iodoform—How is it made? What are its uses?

CHAPTER LIV

PRODUCTS OF THE ACTION OF FERMENTS UPON ACID SACCHARINE FRUITS

The acid saccharine fruits form an important class in medicine and pharmacy. Their principal constituent is usually a vegetable acid (in some fruits several acids are found); sugar and albuminous principles are present in small amount, and on account of their presence vinous fermentation may be induced in their juices, resulting in the production of important alcoholic liquors. The fruits of this class which contribute the most useful products to pharmacy are grapes, lemons, limes, oranges, apples, tamarinds, raspberries, mulberries, pineapples, strawberries, currants, blackberries, etc. Most of the juices of these fruits readily undergo fermentation. The clear alcoholic liquid left after decomposition has received various names according to the fruit from which it is derived,—viz., wine from grapes, cider from apples, perry from pears, etc.

The products of the grape will be considered first.

In the U. S. P. VIII white wine and red wine were official. They were not admitted to the U. S. P., IX because all medicated wines were deleted, and therefore, no wine was required for their preparation. In the N. F. IV sherry wine replaced other kinds for use in the medicated wines, it will be found on page 1092. The former official description is as follows:

VINUM ALBUM. U. S. P. VIII. White Wine

An alcoholic liquid, made by fermenting the juice of fresh grapes, the fruit of *Vitis vinifera* Linné (Fam. *Vitaceæ*), freed from seeds, stems, and skins, and subjected to the usual cellar-treatment for fining and aging.

When White Wine is prescribed without further specification, it is recommended that a dry White Wine of domestic production be employed.

White Wine should be preserved in well-closed casks, filled as full as possible, or in well-stoppered bottles, in a cool place.

VINUM RUBRUM. U. S. P. VIII. Red Wine

An alcoholic liquid, made by fermenting the juice of fresh red-colored grapes, the fruit of *Vitis vinifera* Linné (Fam. *Vitaceæ*) in presence of their skins, and subjected to the usual cellar-treatment for fining and aging.

When Red Wine is prescribed without further specification it is recommended that a dry Red Wine of domestic production be employed.

Red Wine should be preserved in well-closed casks, filled as full as possible, or in well-stoppered bottles, in a cool place.

The grape is the fruit of *Vitis vinifera*; the juice contains grape sugar, tannin, acid potassium tartrate, calcium tartrate, potassium sulphate, sodium chloride, pectin, albuminous principles, and water. It will be seen that grape juice naturally contains all the substances essential to the production of vinous fermentation, a favorable temperature and the presence of the atmosphere alone being needed to convert it into wine.

Preparation.—The grape juice is run into vats, and constitutes the *must*. The temperature of the air being about 15.56° C. (60° F.), fermentation gradually takes place in the must, which becomes sensibly warmer and emits a large quantity of carbon dioxide. The liquor from being sweet becomes vinous, owing to the conversion of the grape sugar into alcohol. When the liquor has acquired a strong vinous taste and become perfectly clear, the wine is considered formed, and is racked off into casks. But even after this stage of the process the fermentation continues for several months. During the whole of this period a frothy matter is formed, which for the first few days collects around the bung, but afterwards precipitates along with coloring matter and tartar, forming a deposit which constitutes the wine lees. Wines are sweet, dry, light, sparkling, still, acid, or rough, according to the character of the grape juice and the method employed in making the wine. When the quantity of sugar in the juice is large, and the amount of ferment insufficient to convert all the sugar into alcohol, a *sweet* wine is produced; if, on the other hand, the quantity of ferment is sufficient to convert all the sugar into alcohol, a *strong* or *generous* wine is formed. If only a moderate amount of sugar is present in the juice, with enough ferment to convert all of it into alcohol, the wine is termed *dry*. A small portion of sugar results in the production of a *light* wine; if a large quantity of ferment is present, however, a *sour* wine is produced, because the fermentation has progressed until acetic acid is formed. Wines are *sparkling* or *still* according as they contain carbon dioxide or not, and, if fermented in contact with the seeds, which contain tannin, they are *rough* or astringent. Any of the commercial brands of wine which fulfil the requirements of the Pharmacopœia VIII may be classed as white or red wine respectively.

White wine was officially described as follows:

Official Description.—A pale amber-colored or straw-colored liquid.

Odor and Taste.—Pleasant odor free from yeastiness; fruity, agreeable, slightly spirituous taste without excessive sweetness or acidity.

Specific Gravity.—Not less than 0.990 nor more than 1.010 at 15.56° C. (60° F.).

Tests for Identity.—If a portion of White Wine be evaporated, the residue, when dried during twelve hours on a water-bath, should amount to not less than 1.5 nor more than 3 per cent.; this residue ignited at a low temperature and burned gradually to whiteness, moistened with a small portion of ammonium carbonate T.S., and again carefully ignited, should weigh not less than 0.14 Gm. nor more than 0.26 Gm. for each 100 mils of White Wine tested.

Impurities and Tests for Impurities.—*Limit of Free Acid.*—To neutralize 50 mils of White Wine should require not less than 3 nor more than 5.2 mils of normal potassium hydroxide V.S., litmus T.S. being used as indicator.

More than Traces of Tannic Acid.—If 10 mils of White Wine be diluted with an equal volume of water, and treated with 5 drops of ferric chloride T.S., only a faint, greenish-brown color should make its appearance.

Saccharin.—If 75 mils of White Wine be acidified with 5 mils of diluted sulphuric acid (1 in 3), and thoroughly shaken in a separator with a mixture of equal parts of petroleum benzin and ether, and if the solvent, after separation, be transferred to a porcelain dish, allowed to evaporate spontaneously, and the residue dissolved in 3 mils of water, the solution should not have a sweet taste

Salicylic Acid.—nor should it give a violet color upon the addition of a diluted solution of ferric chloride (1 in 200).

Quantitative Test.—Tested by the following method, White Wine should be found to contain not less than 7 per cent. nor more than 12 per cent., by weight (equivalent to 8.5 per cent. to 15 per cent. by volume), of absolute alcohol.

Take the specific gravity (to four decimals) of a sufficient portion of the White Wine carefully measured at the temperature of 15.56° C. (60° F.), evaporate the wine in a tared dish to one-third of its original weight, cool, and add water until the liquid measures its original volume at 15.6° C. (60° F.); then take the specific gravity (to four decimals) again. The difference between the two specific gravities deducted from 1.0000 corresponds to the specific gravity of an alcohol containing the same precentage of absolute alcohol, by weight or volume, as the Wine under examination, the corresponding percentage being ascertained by referring to the alcohol tables. (See page 1056.)

Red wine was officially described as follows:

Official Description.—A deep red liquid.

Odor and Taste.—Pleasant odor free from yeastiness; fruity, moderately astringent, pleasant, and slightly acidulous taste, without excessive sweetness or acidity.

Specific Gravity.—Not less than 0.989 nor more than 1.110 at 15.56° C. (60° F.).

Tests for Identity.—If a portion of Red Wine be evaporated, the residue, when dried during twelve hours on a water-bath, should amount to not less than 1.6 per cent. nor more than 3.5 per cent.; this residue, ignited at a low temperature and burned gradually to whiteness, moistened with a small portion of ammonium carbonate T.S., and again carefully ignited, should weigh not less than 0.22 Gm. nor more than 0.34 Gm. for each 100 mils of Red Wine tested.

If 10 mils of Red Wine be diluted with an equal volume of water, and treated with 5 drops of ferric chloride T.S., the liquid should acquire a brownish-green color (presence of *tannic acid*).

With lead acetate T.S. Red Wine forms a heavy precipitate which may vary in color from bluish-green to green

Impurities and Tests for Impurities.—*Limit of Free Acid.*—To neutralize 50 mils of Red Wine should require not less than 3 mils nor more than 5.2 mils of normal potassium hydroxide V.S., litmus T.S. being used as indicator.

Red Aniline Colors.—If 50 mils of Red Wine be treated with a slight excess of ammonia water, the liquid should acquire a green or brownish-green color; if it be then well shaken with 25 mils of ether, the greater portion of the ethereal layer removed, and evaporated in a porcelain dish with an excess of acetic acid and a few fibers of uncolored silk, the latter should not acquire a crimson or violet color.

Acid Fuchsin.—If 25 mils of Red Wine, heated to about 45° C. (113° F.), be well agitated with 25 Gm. of manganese dioxide, the liquid filtered off and acidulated with hydrochloric acid, it should not acquire a red color.

Saccharin.—If 75 mils of Red Wine be acidified with 5 mils of diluted sulphuric acid (1 in 3) and thoroughly shaken in a separator with a mixture of equal parts of petroleum benzin and ether, and if the solvent after separation be transferred to a porcelain dish, allowed to evaporate spontaneously, and the residue dissolved in 3 mils of water, the solution should not have a sweet taste

Salicylic Acid.—nor should it give a violet color upon the addition of a diluted solution (1 in 200) of ferric chloride.

Quantitative Test.—Tested by the following method, Red Wine should be found to contain not less than 7 per cent. nor more than 12 per cent., by weight (equivalent to 8.5 per cent. to 15 per cent. by volume), of absolute alcohol:

Take the specific gravity (to four decimals) of a sufficient portion of the Red Wine accurately measured at the temperature of 15.56° C. (60° F.), evaporate the Wine in a tared dish to one-third of its original weight, cool, and add water until the liquid measures its original volume at 15.56° C. (60° F.); then take the specific gravity (to four decimals) again. The difference between the two specific gravities deducted from 1.0000 corresponds to the specific gravity of an alcohol containing the same percentage of absolute alcohol, by weight or volume, as the Wine under examination, the corresponding percentage being ascertained by referring to the alcohol tables. (See page 1056.)

The explanation of the official quantitative test for the amount of alcohol in wine is based upon the assumption that when the alcohol from a measured weight of wine at a given temperature is entirely evaporated without boiling or wasting it, and when the original volume has been exactly restored by the addition of pure water at the same temperature, the difference between the two specific gravities deducted from 1.0000 expresses the specific gravity of an alcoholic liquid of the same strength as that in the wine. By referring to the alcohol table the percentage of alcohol by weight corresponding to this specific gravity is ascertained, and thus the percentage of alcohol in the wine is obtained.

An example will illustrate this. The original specific gravity of a sample of wine is 0.9875 at 15.56° C. (60° F.) after the evaporation of the alcohol and the restoration of the original volume, the specific gravity is found to be 1.0080. This figure represents the solids and water in the wine. If the specific gravity of water (1.0000) now be subtracted from this, the resulting figure will be 0.0080, which represents the solids and may be used as a correction factor in the original specific gravity. Subtracting therefore 0.0080 from 0.9875, a figure is obtained (0.9795) which upon referring to the alcohol table, indicates about 13 per cent. of alcohol by weight, or about 16 per cent. by volume. A more accurate method for determining the alcoholic per cent. of wine will be found in the U. S. P., Test No. 14, Chapter LXII.

The aroma of wines, termed their "bouquet," depends upon the formation of certain esters during the fermentation, and also during the aging or ripening process. These are said to be *œnanthic, caprylic, butyric, caproic, acetic,* and *pelargonic esters.*

Argol.—During the fermentation of wines, especially those that are acid, a peculiar matter is deposited upon the sides and bottom of the casks, forming a crystalline crust, called *crude tartar,* or *argol.* That deposited from red wines is of a reddish color, and is called *red argol;* that derived from white wines is of a dingy white color, and is denominated *white argol.* Both kinds consist of acid potassium tartrate rendered impure by calcium tartrate, more or less coloring matter, and other substances which are deposited during the clarification of the wine. The deposition of the tartar is thus explained; the acid tartrate exists naturally in the juice of the grape, held in solution by the sweet aqueous liquid; when the juice is submitted to fermentation in the process for converting it into wine, the sugar disappears, and is replaced by alcohol, in which the salt is insoluble. It is from this substance that acid potassium tartrate is obtained by a process of purification (see Potassii Bitartras, page 719), and from the latter tartaric acid is produced.

Uses.—The use of wine pharmaceutically as a menstruum for a class of preparations, is no longer in favor because of the variable quality and character of the commercial wines. All wines were deleted from the U. S. P. for this reason but were included in the N. F. (see page 512).

In the manufacturing laboratories, however, a fortified wine is largely used as the menstruum for pharmaceutical products, where low-alcoholic strength is required, as it may be bought without paying the internal revenue tax for alcohol and thus effects a saving in cost. Medicinally, wine is used as a stimulant.

VINUM XERICUM. N. F. Sherry Wine
[Vin. Xeric.]

An alcoholic liquid made by fermenting the juice of fresh ripe grapes, the fruit of cultivated species of *Vitis* Linné (Fam. *Vitaceœ*), freed from seeds, stems and skins, and fortifying with pure grape brandy. It contains not less than 16 per cent. nor more than 24 per cent. of C_2H_5OH, by volume, when estimated as directed in the U. S. P., Test No. 14, Chapter LXII. Preserve it in well-closed casks or in well-stoppered bottles, in a cool place.

Official Description.—A pale yellowish-brown or amber-colored liquid.

Odor and Taste.—It has a pleasant, aromatic odor, free from yeastiness, and a fruity, characteristic taste without excessive sweetness or acidity.

Specific Gravity.—From 0.985 to 1.000 at 25° C. (77° F.).

Tests for Identity and Impurities.—Evaporate 100 mils of Sherry Wine in a tared dish, on a water bath, and dry the residue to constant weight at 100° C. (212° F.); it weighs not less than 3 Gm. nor more than 7 Gm. Ignite this residue at a low temperature and burn it gradually to whiteness, moisten the ash with a small portion of ammonium carbonate T.S. and again carefully ignite; the ash weighs not less than 0.175 Gm. nor more than 0.5 Gm.

Free Acid.—Dilute 50 mils of Sherry Wine with 200 mils of distilled water; it requires for neutralization not less than 20 mils nor more than 40 mils of tenth-normal potassium hydroxide V.S., using phenolphthalein T S. as indicator.

Sulphate.—Acidulate 50 mils of Sherry Wine with hydrochloric acid, heat and add an excess of barium chloride T.S. Collect the precipitate on a filter of known ash content, wash it thoroughly, dry, and ignite; the residue weighs not more than 0.034 Gm.

Tannic Acid.—To 10 mils of Sherry Wine add an equal volume of distilled water and 5 drops of ferric chloride T.S.; not more than a faint greenish-brown color appears.

Saccharin.—Add 10 mils of diluted sulphuric acid to 75 mils of Sherry Wine and shake out the mixture in a separator twice, using each time 20 mils of a mixture of equal volumes of purified petroleum benzin and ether. Transfer the separated benzin-ether solution to an evaporating dish, allow the solvent to evaporate spontaneously and dissolve the residue in 3 mils of distilled water; the solution does not have a sweet taste

Salicylic Acid.—nor does it yield a violet color upon the addition of a few drops of a dilute solution of ferric chloride (1 in 200).

N. F. Preparation.—Elixir Gentianæ Glycerinatum; N. F. Wines.

Brandy is no longer official in the U. S. P. but the U. S. P. VIII description is as follows:

SPIRITUS VINI GALLICI. U. S. P. VIII. Brandy

An alcoholic liquid obtained by the distillation of the fermented, unmodified juice of fresh grapes.

Preparation.—Brandy varies in quality according to the source from which it is obtained. The best brandy is obtained from French wines, and the kind called Cognac is most esteemed. Very large quantities of brandy are now made in California, but the taste is peculiar and easily distinguished from that of Cognac. The Pharmacopœia recognized all spirits when obtained from the juice of grapes, if sufficiently strong and pure to meet the tests given below.

Brandy owes its aroma to œnanthic and acetic ethers and other volatile products. (See Vinum Album.) Œnanthic ether is known chemically as ethyl pelargonate, $C_{11}H_{22}O_2$, but in commerce it is called *oil of cognac*. It is a fragrant, ethereal oil, of a greenish color, and is largely used in making factitious brandy.

Official Description.—A pale amber-colored liquid. Brandy should be at least four years old.

Odor, Taste, and Reaction.—Distinctive odor and taste; slightly acid reaction.

Specific Gravity.—Not more than 0.941 nor less than 0.925 at 15.56° C. (60° F.), corresponding, approximately, to an alcoholic strength of 39 to 47 per cent. by weight, or 46 to 55 per cent. by volume, of absolute alcohol.

Impurities and Tests for Impurities.—*Fusel Oil from Grain or Potato Spirit.*—If 100 mils of Brandy be slowly evaporated in a tared dish on a water-bath, the last portions volatilized should have an agreeable odor free from harshness.

Added Sugar, Glycerin, and Aromatic Substances.—The residue, when dried at 100° C. (212° F.), should not weigh more than 0.5 Gm. This residue should have no sweet or distinctly spicy taste.

More than Traces of Oak Tannin from Casks.—This residue should almost completely dissolve in 10 mils of cold water, forming a solution which is colored not deeper than light green by a few drops of ferric chloride T.S. diluted with 10 volumes of water.

Limit of Free Acid.—To render 100 mils of Brandy distinctly alkaline to litmus, not more than 1 mil of normal potassium hydroxide V.S. should be required.

Uses.—Brandy is employed as a stimulant, and is often administered with milk, yolk of eggs, etc.

ACIDUM TARTARICUM. U. S. Tartaric Acid

[Acid. Tart.]

A dibasic organic acid usually obtained from wine lees or argol. It contains not less than 99.5 per cent. of $C_4H_6O_6$ or $C_2H_2(OH)_2(COOH)_2$ (150.05).

Preparation.—This important acid may be prepared by saturating the excess of acid in acid potassium tartrate or cream of tartar with calcium carbonate, and decomposing the resulting insoluble calcium tartrate by sulphuric acid, which precipitates in combination with the lime of calcium sulphate, and liberates the tartaric acid. The process, when thus conducted, furnishes only one-half of the tartaric acid. The other half may be procured by decomposing the neutral potassium tartrate remaining in the solution after the precipitation of the calcium tartrate by calcium chloride in excess. By double decomposition, potassium chloride will be formed in solution, and a second portion of calcium tartrate will precipitate, which may be decomposed by sulphuric acid together with the first portion.

$$\underset{\substack{\text{Acid Potassium}\\\text{Tartrate}}}{2KHC_4H_4O_6} + \underset{\substack{\text{Calcium}\\\text{Carbonate}}}{CaCO_3} = \underset{\substack{\text{Potassium}\\\text{Tartrate}}}{K_2C_4H_4O_6} + \underset{\substack{\text{Calcium}\\\text{Tartrate}}}{CaC_4H_4O_6} + \underset{\text{Water}}{H_2O} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{CO_2}$$

then

$$\underset{\substack{\text{Potassium}\\\text{Tartrate}}}{K_2C_4H_4O_6} + \underset{\substack{\text{Calcium}\\\text{Chloride}}}{CaCl_2} = \underset{\substack{\text{Calcium}\\\text{Tartrate}}}{CaC_4H_4O_6} + \underset{\substack{\text{Potassium}\\\text{Chloride}}}{2KCl}$$

and

$$\underset{\substack{\text{Calcium}\\\text{Tartrate}}}{2CaC_4H_4O_6} + \underset{\substack{\text{Sulphuric}\\\text{Acid}}}{2H_2SO_4} = \underset{\substack{\text{Calcium}\\\text{Sulphate}}}{2CaSO_4} + \underset{\text{Tartaric Acid}}{2H_2C_4H_4O_6}$$

Calcium sulphate is sometimes substituted for calcium chloride in the second stage of the decomposition. Tartaric acid is a dibasic acid; one or two of its hydrogen atoms are capable of being replaced by metals. With monad metals, acid, neutral, and double tartrates may be formed, thus:

$C_4H_4O_6$	$C_4H_4O_6$	$C_4H_4O_6$	$C_4H_4O_6$
H_2	HK	K_2	KNa
Tartaric Acid	Acid Potassium Tartrate	Neutral Potassium Tartrate	Potassio-Sodium Tartrate

Tartaric acid contains no water of crystallization. The tartrates are important salts. Three are official, two of them being double salts,—viz., antimony and potassium tartrate, potassium and sodium tartrate; the other salt is potassium bitartrate. Tartrates may be recognized by becoming blackened on the addition of sulphuric acid, evolving at the same time an empyreumatic odor. Their solutions, if neutral, yield with calcium chloride white precipitates of calcium tartrate, which are soluble in solution of potassium hydroxide. Tartaric acid is recognized by a strong solution producing with a solution of potassium hydroxide a crystalline precipitate of acid potassium tartrate.

Official Description.—It occurs in colorless, translucent, monoclinic prisms, or as a white, granular or fine powder; permanent in the air.

Odor, Taste, and Reaction.—Odorless, having an acid taste. An aqueous solution of Tartaric Acid (1 in 20) is acid to litmus.

Solubility.—One Gm. of Tartaric Acid dissolves in 0.75 mil of water and in 3.3 mils of alcohol at 25° C. (77° F.); also in 0.5 mil of boiling water; almost insoluble in chloroform, slightly soluble in ether.

Tests for Identity.—An aqueous solution of the Acid (1 in 2) mixed with an equal volume of an aqueous solution of potassium acetate (1 in 3) yields a white, crystalline precipitate, which is dissolved by solutions of alkalies and by mineral acids, but is insoluble in acetic acid.

When slowly ignited it is gradually decomposed, evolving an odor resembling burning sugar.

Impurities and Tests for Impurities.—Incinerate about 2 Gm. of Tartaric Acid; not more than 0.05 per cent. of ash remains.

Sulphuric Acid.—The addition of 1 mil of barium chloride T.S. to 10 mils of an aqueous solution of the Acid (1 in 100), to which has previously been added a few drops of hydrochloric acid, produces no turbidity.

Oxalic Acid.—An aqueous solution of the Acid (1 in 10), in which the free acid has been nearly neutralized with ammonia water, is not affected by calcium sulphate T.S.

Heavy Metals.—Ten mils of an aqueous solution of the Acid (1 in 50), mixed with 0.5 mil of hydrochloric acid, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Lead.—Dissolve 10 Gm. of Tartaric Acid in 20 mils of distilled water, add 2 mils of sulphurous acid and boil the mixture until the odor of sulphur dioxide is barely perceptible. Cool the solution, mix it with 1 mil of sodium cyanide T.S. and follow this immediately with stronger ammonia water until the precipitate formed is redissolved and the solution has a slight odor of ammonia. When cold, transfer the solution to a glass-stoppered cylinder, graduated to 50 mils. Dilute it with sufficient distilled water to measure 50 mils and add 3 drops of sodium sulphide T.S. After mixing well, the color produced in the solution, if any, when viewed downward against a white surface, is not greater than the color of a control solution prepared as follows: Dissolve 2 Gm. of ammonium chloride (see Reagents, Chapter LXII) in 20 mils of distilled water, add 4 mils of a solution containing 0.08 Gm. of lead nitrate in 1000 mils of distilled water, and then 1 mil of diluted hydrochloric acid. Treat this solution with the same quantity of sulphurous acid, sodium cyanide T.S. and stronger ammonia water, as directed above, transfer to another 50 mil glass-stoppered cylinder, then dilute it with sufficient distilled water to make 50 mils, and add three drops of sodium sulphide T. S. (Before adding the sodium sulphide T.S., the liquid must possess a distinct odor of ammonia and the two cylinders used must be matched, be of practically colorless glass, and have the same internal diameter.)

Assay.—Dissolve about 3 Gm. of Tartaric Acid, accurately weighed, in 50 mils of distilled water and titrate this solution with normal potassium hydroxide V.S., using phenolphthalein T.S. as indicator. It shows not less than 99.5 per cent. of $C_4H_6O_6$. Each mil of normal potassium hydroxide V.S. consumed corresponds to 0.07503 Gm. of $C_4H_6O_6$. Each gramme of Tartaric Acid corresponds to not less than 13.26 mils of normal potassium hydroxide V.S.

U. S. P. Preparation.—Acidum Hydriodicum Dilutum; Caffeina Citrata Effervescens; Extractum Aconiti; Extractum Hydrastis; Extractum Physostigmatis; Potassii Citras Effervescens; Pulvis Effervescens Compositus; Sodii Phosphas Effervescens.

N. F. Preparations.—Elixir Pepsini, Bismuthi et Strychninæ; Glyceritum Bismuthi; Liquor Alumini Acetico-Tartratis; Liquor Sodii Citro-tartratis Effervescens; Sal Carolinum Factitium Effervescens; Sal Kissingense Factitium Effervescens; Sal Lithii Citras Effervescens; Sal Potassii Bromidi Effervescens; Sal Potassii Bromidi Effervescens Compositus; Sal Vichyanum Factitium Effervescens; Sal Vichyanum Factitium Effervescens cum Lithio.

The list of preparations into which tartaric acid enters officially is given above. It is chiefly used as the acid ingredient of a reaction and will not be found as free acid in the finished product.

ACIDUM CITRICUM. U. S. Citric Acid

[Acid. Cit.]

A tribasic organic acid usually obtained from the juice of limes or lemons. It contains not less than 99.5 per cent. of $C_6H_8O_7+H_2O$. or $C_3H_4(OH)(COOH)_3+H_2O$ (210.08). Preserve it in well-closed containers.

Preparation.—Although this acid is found in many plants, it is obtained upon a commercial scale only from the juice of limes and lemons. It is extracted from *lime juice* (see page 1099) by a very simple process, but one requiring some careful manipulation. The boiling juice is first completely saturated with calcium carbonate (chalk or whiting) in fine powder, and the calcium citrate formed is allowed to subside. This is then washed repeatedly with water, and decomposed by diluted sulphuric acid. An insoluble calcium sulphate is precipitated, and the disengaged citric acid remains in solution. This is carefully concentrated in leaden boilers until a pellicle begins to form, when it is transferred to other vessels to cool and crystallize.

$$\underset{\text{Citric Acid in Lime Juice}}{2H_3C_6H_5O_7} + \underset{\text{Calcium Carbonate}}{3CaCO_3} = \underset{\text{Calcium Citrate}}{Ca_32C_6H_5O_7} + \underset{\text{Water}}{3H_2O} + \underset{\text{Carbon Dioxide}}{3CO_2}$$

$$\underset{\text{Calcium Citrate}}{Ca_32C_6H_5O_7} + \underset{\text{Sulphuric Acid}}{3H_2SO_4} = \underset{\text{Citric Acid}}{2H_3C_6H_5O_7} + \underset{\text{Calcium Sulphate}}{3CaSO_4}$$

Citric acid contains one molecule of water of crystallization. It differs in this respect from tartaric acid, which contains none. It is a tribasic acid; in other words, three atoms of hydrogen are replaceable by metals, three classes of citrates being formed according as one, two, or three hydrogen atoms are replaced.

The citrates are a valuable class of medicinal salts, nine being official,—five of which are simple salts, one granular effervescent, and three are double,—as follows: ferric, bismuth, lithium, potassium and sodium citrates, effervescent potassium citrates, bismuth and ammonium citrate, iron and ammonium citrate, iron and quinine citrate. It is used in two solutions,—solution of magnesium citrate, and solution of potassium citrate. The numerous other official preparations into which it enters will be found below.

Official Description.—It occurs in colorless, translucent, right-rhombic prisms, or as a white powder, efflorescent in warm air.

Odor, Taste, and Reaction.—Odorless and having an acid taste. An aqueous solution of Citric Acid (1 in 20) is acid to litmus.

Solubility.—One Gm. of Citric Acid dissolves in 0.5 mil of water, 1.8 mils of alcohol and in about 30 mils of ether at 25° C. (77° F.); also in 0.5 mil of boiling water.

Tests for Identity.—Add 1 mil of an aqueous solution of the Acid (1 in 10) to 50 mils of calcium hydroxide T.S. (or sufficient of the latter to render the mixture alkaline); the liquid remains clear. When boiled for about one minute, the solution becomes opaque through the precipitation of calcium citrate.

When slowly ignited, Citric Acid is gradually decomposed without emitting an odor resembling burning sugar (difference from *tartaric acid*).

Impurities and Tests for Impurities.—Incinerate about 2 Gm. of Citric Acid; not more than 0.05 per cent. of ash remains.

Oxalic Acid.—An aqueous solution of Citric Acid (1 in 10), which has been nearly neutralized with ammonia water, remains clear on the addition of calcium sulphate T.S.

Tartaric Acid.—Heat about 5 Gm. of powdered Citric Acid for fifteen minutes on a water bath with 5 mils of sulphuric acid in a porcelain dish, which has previously been rinsed with sulphuric acid, keeping the mixture protected from dust; no darker color than yellow develops.

Heavy Metals.—Ten mils of an aqueous solution of the Acid (1 in 50) mixed with 0.5 mil of hydrochloric acid does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Sulphuric Acid.—The addition of 1 mil of barium chloride T.S. to 10 mils of an aqueous solution of the Acid (1 in 100), to which have previously been added a few drops of hydrochloric acid, produces no turbidity.

Lead.—Dissolve 10 Gm. of Citric Acid in 20 mils of distilled water, add 2 mils of sulphurous acid and boil the mixture until the odor of sulphur dioxide is barely perceptible. Cool the solution, mix it with 1 mil of sodium cyanide T.S. and follow this immediately with stronger ammonia water until the solution possesses a slight odor of ammonia. When cold, transfer the solution to a glass-stoppered cylinder graduated at 50 mils, dilute it with sufficient distilled water to measure 50 mils, and add 3 drops of sodium sulphide T.S. After mixing well, the color produced in the solution, if any, when viewed downward against a white surface, is not greater than the color of a control solution prepared as follows: Dissolve 2 Gm. of ammonium chloride (see Reagents, Chapter LXII) in 20 mils of distilled water, add 4 mils of a solution containing 0.08 Gm. of lead nitrate in 1000 mils of distilled water, and then 1 mil of diluted hydrochloric acid. Treat this solution with the same quantity of sulphurous acid, sodium cyanide T.S. and stronger ammonia water, as directed above, transfer to another 50-mil, glass-stoppered cylinder, then dilute it with sufficient distilled water to make 50 mils and add 3 drops of sodium sulphide T.S. (before adding the sodium sulphide T.S., the liquid must possess a distinct odor of ammonia, and the two cylinders used must be matched, be of practically colorless glass, and have the same internal diameter).

Assay.—Dissolve about 3 Gm. of the Acid, accurately weighed, in 50 mils of distilled water and titrate the solution with normal potassium hydroxide V.S., using phenolphthalein T.S. as indicator. It shows not less than 99.5 per cent. of $C_6H_8O_7+H_2O$. Each mil of normal potassium hydroxide V.S. used corresponds to 0.07003 Gm. of $C_6H_8O_7+H_2O$. Each gramme of Citric Acid corresponds to not less than 14.2 mils of normal potassium hydroxide V.S.

U. S. P. Preparation.—Caffeina Citrata; Caffeina Citrata Effervescens; Liquor Magnesii Citratis; Liquor Potassii Citratis; Potassii Citras Effervescens; Sodii Phosphas Effervescens; Syrupus Acidi Citrici; Syrupus Aurantii; Syrupus Lactucarii.

N. F. Preparations.—Elixir Ferri Pyrophosphatis, Quininæ et Strychninæ; Elixir Zinci Valeratis; Liquor Ammonii Citratis; Liquor Ferri Citratis; Liquor Ferri Salicylatis; Liquor Magnesii Sulphatis Effervescens; Liquor Phosphatum Compositus; Liquor Sodii Citratis; Liquor Sodii Citro-Tartratis Effervescens; Liquor Sodii Phosphatis Compositus; Sal Carolinum Factitium Effervescens; Sal Kissingense Factitium Effervescens; Sal Lithii Citratis Effervescens; Sal Potassii Bromidi Effervescens; Sal Potassii Bromidi Effervescens Compositus; Sal Vichyanum Factitium Effervescens; Sal Vichyanum Factitium Effervescens cum Lithio.

Uses.—Citric acid in solution is used as a substitute for lemon juice. The dose is from five to thirty grains (0.3 to 2 Gm.). It is rarely given in its free state, but is largely used in combination and in many solutions and syrups, and in making effervescent salts.

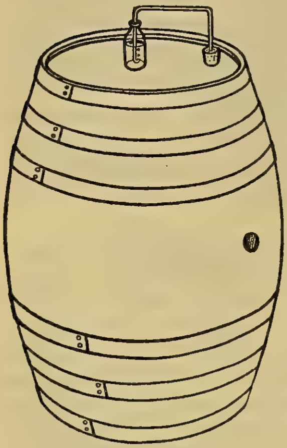
Acid Saccharine Fruits Containing Pectinous Bodies

The pulpy constituents of fruits and fleshy roots undergo naturally certain changes when subjected to the influences of a ferment known as *pectase*. These changes can be closely imitated artificially when the pulp is treated with acids or alkalies in aqueous solution, by the aid of heat. According to Fremy, pectase exists in fruits in either a soluble or an insoluble condition. Green unripe fruits contain *pectose*, a substance which is supposed to be isomeric with cellulin, and which gives to such fruits their hardness. Pectose is insoluble in water, alcohol, or ether.

In the process of ripening fruits, the pectase slowly acts on the pectose, the hardness disappears, *pectin* is formed, and the fruit is soft and ripe. When it is overripe, *parapectin* and *metapectic acid* are produced. The moderate action of heat and water upon fruits is thus explained. The citric, tartaric, or malic acid in the fruit acts on the pectose, softening it, and converting it into pectin, and the pectin is then acted upon by the ferment pectase, which causes it to gelatinize, on cooling, through the production of pectosic acid. This is the cause of the formation of fruit jellies. The *rapid* application of strong heat to the pulp of fruits results in the coagulation and destruction of the ferment pectase, and the production of jelly is thus prevented.

Alkalies form soluble compounds with pectosic acid and pectin, and hence, when gelatinous precipitates are found in fluidextracts and tinctures, due to the formation of either of these substances, they may be dissolved by the application of an alkaline solution. The use of solution of potassium hydroxide in fluidextract of senega is an illustration of this.

FIG. 448



Preparation of fruit juice by fermentation

Fruit Juices.—These are largely used for flavoring syrups, and for use in dispensing soda water. They are made by expressing the juice from fresh fruits, and bottling as directed in the chapter on syrups (see page 317). They are often made by separating the pectinous substances by fermentation (see Fig. 448). A stout cask is selected and arranged as shown in the illustration; it is tightly closed, but provided with a suitable means of escape for the carbon dioxide. The fermentation is known to have stopped when gas bubbles no longer escape through the water contained in the bottle. The addition of 2 per cent. of sugar to the weight of the fruit facilitates fermentation, aids in the filtration, and in preserving the color of the juice.

There are two fruits belonging to this class, the raspberry and blackberry, official in the N. F. IV and it includes many well known fruits which are not official (see page 1101).

RHUS GLABRA. N. F. Rhus Glabra

(U.S.P. VIII)

[**Rhus Glab.**—SUMAC BERRIES]

The dried, ripe fruit of *Rhus glabra* Linné (Fam. *Anacardiaceæ*), without the presence of more than 5 per cent. of stems or other foreign matter.

This fruit owes its acidity to malic acid, which exists in it as calcium and potassium malate. This acid is found in unripe apples and in a great number of fruits, roots, leaves, stems, etc. Rhus glabra also contains tannin, gallic acid, and red coloring matter.

Malic acid may be obtained from rhus glabra by exhausting the berries with water, evaporating, filtering, and crystallizing the acid calcium malate, which is then dissolved in boiling water, and treated with lead acetate, when lead malate is precipitated; this is then suspended in water, hydrogen sulphide is passed through it, lead sulphide is precipitated, and the solution of malic acid is evaporated to permit crystallization. Malic acid is found in colorless shining needles having a sour taste and an acid reaction. It is soluble in alcohol and deliquescent in the air. It is dibasic.

Official Description.—Nearly globular, ovoid, more or less reniform, somewhat compressed, about 5 mm. in length and 2 mm. in diameter; externally dark red, velvety with short hairs, summit with remains of the short style, base occasionally with the five-cleft calyx and a short pedicel; endocarp, smooth, shiny, light red; one-celled, one-seeded; seeds dark brown, smooth.

Odor and Taste.—Inodorous; taste acidulous and slightly astringent.

Tests for Identity and Purity.—The powder is brownish-red, and, when examined under the microscope, exhibits irregular fragments; non-glandular hairs, more or less elliptical or ovoid or spatulate, about 0.15 mm. in length and from 0.045 to 0.08 mm. in width, filled with a pink or red cell sap in which occasionally occur rod-shaped crystals; glandular hairs with a short one-celled stalk and multicellular head, from 0.045 to 0.075 mm. in length; fragments of endosperm numerous; fragments of endocarp showing very small stone cells with irregularly thickened walls, readily determined by the use of aniline sulphate T.S. and sulphuric acid; fragments of embryo with rather small cells containing a fixed oil; occasional reddish colored fragments of epidermis and underlying spiral tracheæ of the mesocarp.

Mix 1 Gm. of powdered Rhus Glabra with 10 mils of hot water, shake the mixture occasionally until cold, filter, and allow the filtrate to evaporate spontaneously in a watch crystal; numerous, feather-shaped crystals separate which polarize light strongly with a distinct play of colors.

Rhus Glabra yields not more than 4 per cent. of ash.

N. F. Preparations.—Fluidextractum Rhois Glabræ.

Uses.—Rhus glabra is a useful refrigerant and astringent. The dose is fifteen grains to one drachm (1 to 4 Gm.).

RUBI FRUCTUS. N. F. Blackberries

The fresh, ripe fruit of varieties of *Rubus nigrobaccus* Bailey or *Rubus villosus* Aiton (Fam. *Rosaceæ*).

Official Description.—An aggregate fruit, ovate to oblong, rounded or slightly pointed, composed of numerous, shining black drupelets attached to an esculent receptacle; pericarp externally smooth or with only a few hairs (*R. villosus*), mesocarps fleshy, juice purple-red, endocarps hard, black, surfaces deeply wrinkled.

N. F. **Preparations.**—Cordiale Rubi Fructus (from Syrup); Elixir Rubi Compositum (from Syrup); Syrupus Rubi Fructus.

Uses.—The fruit has a pleasant flavor and is used as an astringent, chiefly in diarrhea.

RUBI IDÆI FRUCTUS. N. F. Raspberries

A fresh, ripe fruit of varieties of *Rubus Idæus* Linné or of *Rubus strigosus* Michaux (Fam. *Rosaceæ*).

Official Description.—An aggregate fruit, globular or hemispherical with a concave depression at the base where separated from the receptacle, composed of twenty or more small, rounded-polygonal, succulent drupelets; pericarps externally red, hairs numerous; mesocarps fleshy, juice red; endocarps small stones with wrinkled surfaces.

Odor and Taste.—Odor characteristic, aromatic; taste pleasant, sweet, acidulous.

For pharmaceutical purposes, Black Raspberries, the fresh ripe Fruit of varieties of *Rubus occidentalis* Linné (Fam. *Rosaceæ*), may be substituted either in part or wholly for Red Raspberries.

N. F. Preparations.—Syrupus Rubi Idæi.

Uses.—The fruit is used only for the preparation of an agreeably flavored syrup.

SUCCUS CITRI. N. F. Lime Juice
[Suc. Cit.]

The expressed juice of the ripe fruit of *Citrus medica acida* (Roxburgh) Bonavia (Fam. *Rutaceæ*), containing in each *one hundred mils* not less than 5 Gm. nor more than 10 Gm. of total acids, calculated as crystallized citric acid [$H_3C_6H_5O_7+H_2O=210.08$].

Official Description.—A clear or slightly turbid, pale yellow or yellowish-green liquid.

Odor, Taste, and Reaction.—It has the characteristic odor and taste of limes.

Specific Gravity.—1.025 to 1.040 at 25° C. (77° F.).

Impurities and Tests for Impurities.—*Nitrate.*—Add 20 mils of solution of sodium hydroxide to 5 mils of Lime Juice in a 100-mil flask and heat on a water bath for ten minutes with 0.5 Gm. of granular aluminum or aluminum foil; no odor of ammonia is noticeable at any time during the heating.

Sulphate.—Add 1 mil of barium chloride T.S. to 5 mils of clear, filtered Lime Juice; only a slight turbidity is produced after standing two minutes.

Chloride.—Add 1 mil of nitric acid, followed by 0.1 mil of silver nitrate T.S., to 5 mils of clear, filtered Lime Juice; only a slight opalescence is produced after standing two minutes.

Acetate.—Warm a mixture of 5 mils each of sulphuric acid, alcohol, and Lime Juice; no odor of acetic ether is developed.

Tartrate.—Add 1 mil of an aqueous solution of potassium acetate (1 in 4) to 5 mils of filtered Lime Juice and then add 15 mils of alcohol to the mixture; a slight cloudiness may occur, but no crystalline precipitate is formed within fifteen minutes.

When evaporated and ignited until free from carbon, Lime Juice leaves not more than 0.5 per cent. of ash. The ash from 5 mils of Lime Juice, when dissolved in a few drops of nitric acid and diluted with distilled water, shows not more than traces of phosphate when tested with ammonium molybdate T.S.

Sulphur Dioxide.—Transfer 10 mils of Lime Juice to a flask having a round bottom and a long neck, add 75 mils of distilled water, 5 mils of phosphoric acid and 1 Gm. of sodium bicarbonate and at once connect the flask with a condenser. Distil 50 mils, receiving the distillate under the surface of 25 mils of tenth-normal iodine V.S., acidulate the distillate with 5 drops of diluted hydrochloric acid, add 1 mil of barium chloride T.S. and heat on a water bath until the liquid is nearly colorless. The precipitate of barium sulphate, if any, when filtered, washed, and ignited, weighs not more than 0.015 Gm., corresponding to not more than 0.04 Gm. of sulphur dioxide in 100 mils of Lime Juice, correction being made for any sulphate which may be present in the 25 mils of tenth-normal iodine V.S.

Alcohol.—To 200 mils of Lime Juice add an excess of calcium hydroxide and distil the liquid until the distillate measures 100 mils; the specific gravity of the distillate indicates not more than 2 per cent. of absolute alcohol, by volume, in the distillate, corresponding to 1 per cent. in the Lime Juice.

Benzoic or Salicylic Acid.—Add to 10 mils of Lime Juice 1 mil of diluted sulphuric acid, then shake it with 25 mils of ether, separate the ether and evaporate it to dryness; the residue is not crystalline, and, when dissolved in 3 mils of distilled water and carefully neutralized with ammonia water, produces neither a pink precipitate nor a purplish color on the addition of 1 drop of ferric chloride T.S.

Artificial Dyes.—Dilute 20 mils of Lime Juice with 100 mils of distilled water, filter if necessary, and add 4 mils of diluted hydrochloric acid. Boil a piece of wool in a very dilute solution of potassium hydroxide T.S., wash with distilled water until free from alkali, then add the washed wool to the Lime Juice solution just prepared and boil for ten minutes. Remove the wool, wash thoroughly in distilled water, and boil in a very dilute solution of hydrochloric acid. After washing out the acid with distilled water, boil with about 200 mils of 2 per cent. solution of ammonium hydroxide until the color on the wool, if any, is dissolved. Remove the wool, add a slight excess of hydrochloric acid to the ammonia solution, and immerse in this solution another piece of wool which has been treated with potassium hydroxide solution in the manner described above. This second piece of wool should not be dyed.

Assay.—Measure accurately 25 mils of Lime Juice, dilute it with 50 mils of distilled water and titrate the solution with normal potassium hydroxide V.S., phenolphthalein T.S. being used as indicator. Not less than 17.8 mils nor more than 35.7 mils of normal potassium hydroxide V.S. is required, indicating the presence of not less than 5 Gm. nor more than 10 Gm. of crystallized citric acid in 100 mils of the Lime Juice. Each mil of normal potassium hydroxide V.S. corresponds to 0.07003 Gm. of citric acid ($C_6H_8O_7+H_2O$). Each mil of Lime Juice requires not less than 0.713 mil nor more than 1.428 mils of normal potassium hydroxide V.S.

N. F. Preparation.—Succus Citri et Pepsinum.

Uses.—This juice is used as a pleasant vehicle for the administration of pepsin. The tests are of necessity unusually comprehensive because of its large use as a beverage.

SUCCUS POMORUM. N. F. Fresh Apple Juice

[Suc. Pomor.]

The freshly expressed juice of sound, ripe, sour apples, the fruit of cultivated varieties of *Pyrus Malus* Linné (Fam. *Rosaceæ*).

N. F. Preparation.—Extractum Ferri Pomatum.

Uses.—Apple juice contains *malic acid* and is used in the preparation of crude iron malate (see page 638).

TAMARINDUS. N. F. Tamarind

(U.S.P. VIII)

[Tamarind.]

The preserved pulp of the fruit of *Tamarindus indica* Linné (Fam. *Leguminosæ*).

Among the constituents of the pulp of tamarinds are citric and tartaric acids; malic acid is present in small quantity.

It frequently contains traces of copper on account of its being evaporated in copper kettles.

A pulpy mass of a light reddish-brown color, changing with age to a dark brown, containing some branching fibers and numerous reddish-brown, smooth, oblong or quadrangular, compressed seeds, each enclosed in a tough membrane. Odor distinct; taste sweet and agreeably acid.

N. F. Preparation.—Confectio Sennæ.

Uses.—This pulp is one of the ingredients in confection of senna. It is purgative, and is often used to make laxative confections. The dose is four drachms (16 Gm.).

Unofficial Fruits

Apple	The fruit of *Pyrus Malus*. The constituents are 7 to 10 per cent. sugar, ½ to 1 per cent. free acid, and 5 per cent. each albuminous and pectinous substances. The fermented juice of the apple is termed *cider* or *vinegar*
Apricot	The fruit of *Prunus Armeniaca*. The average constituents are 1 to 2 per cent. sugar, ½ to 1 per cent. free acid, ½ to 1 per cent. albuminous substances, and 5 to 10 per cent. pectinous substances
Bilberry	The fruit of *Vaccinium resinosum*. The average constituents are 5 per cent. sugar, 1 per cent. free acid, 1 per cent. albuminous substances, and ½ per cent. pectinous substances
Cherry	The fruit of a species of *Prunus*. The average constituents are 8 to 13 per cent. sugar, 1 per cent. free acid, and ½ to 3 per cent. each albuminous and pectinous substances
Currant	The fruit of *Ribes rubrum*. The average constituents are 4 to 7 per cent. sugar, 1 to 2 per cent. free acid, ¼ to ½ per cent. albuminous substances, and ⅙ per cent. pectinous substances
Gooseberry	The fruit of *Ribes Grossularia*. The average constituents are 6 to 8 per cent. sugar, 1 to 1½ per cent. free acid (chiefly citric), ½ per cent. albuminous substances, and ½ to 2 per cent. pectinous substances
Lemon Juice (Limonis Succus) U.S.P. VIII	The freshly expressed juice of the ripe fruit of *Citrus Limonum* Risso (Fam. *Rutaceæ*), a slightly turbid, yellowish liquid. Used as an antiscorbutic and also in the preparation of true neutral mixture and for the making of lemon syrup
Peach	The fruit of *Amygdalus Persica*. The average constituents are 1½ per cent. sugar, ½ per cent. free acid, ½ per cent. albuminous substances, and 6 per cent. pectinous substances
Pear	The fruit of *Pyrus communis*. The average constituents are 7 per cent. sugar, 7 per cent. free acid, ¼ per cent. albuminous substances, and 3 per cent. pectinous substances
Pineapple	The fruit of *Ananassa sativa*. The juice contains 2 per cent. sugar, 1 per cent. free acid, and 3 per cent. albuminous and pectinous substances
Plum	The fruit-tree belonging to the genus *Prunus*. The average constituents are about 1 to 2 per cent. sugar, ½ to 1 per cent. free acid, ½ per cent. albuminous substances, and 2 to 11 per cent. pectinous substances
Strawberry	The fruit of different species of *Fragaria*. The average constituents are 3 to 7 per cent. sugar, 1 per cent. free acid, ½ per cent. albuminous substances, and 2 per cent. pectinous substances

QUESTIONS ON PRODUCTS OF THE ACTION OF FERMENTS UPON ACID SACCHARINE FRUITS

What constituents are normally present in many fruits? (See page 1089.)
What results through fermentation?
Name fruits which yield useful products to pharmacy.
What is white wine? Describe it and give methods of preservation.
What is red wine? Describe it and give method of preservation. What is must?
What constituents are present in grape juice?
How is wine made?

What is meant by the following terms as applied to wines?—Sweet, dry, light, strong or generous, sparkling, still, sour, rough.
Describe appearance, odor, and taste. What is its specific gravity?
How much alcohol should wine contain?
White wine—How may the following impurities be detected?—Free acid; tannic acid; saccharin; salicylic acid.
How was the alcoholic strength of wine ascertained in the U. S. P. VIII?
Describe the U. S. P. IX method for determining alcoholic per cents. of liquid.
Red wine—How may the following impurities be detected?—Free acid; red aniline color; acid fuchsine; saccharin; salicylic acid.
What is the aroma of wines termed, and upon what does it depend?
What ethers are said to be formed in wines?
What is meant by argol?
What is the difference between red and white argol?
Why is argol deposited during the clarification of wine?
What salt is obtained from argol?
What are the uses of wine?
What alcoholic strength is required of wine for pharmaceutical purposes?
How is it obtained, and why is it required?
Sherry wine—What is the Latin title?
Give the N. F. definition. How much alcohol should it contain?
Describe its appearance, odor, and taste, and what is its specific gravity?
How may the following impurities be detected: Free acid; sulphate; tannic acid; saccharin; salicylic acid.
Brandy—What is the Latin name? What was the U. S. P. VIII definition?
What is the best kind.
What kind of brandy was recognized by the U. S. P. VIII?
How much alcohol should brandy contain?
Give description and specific gravity. Describe odor, taste, and chemical reaction.
How may the following impurities be detected?—Fusel oil from grain or potato spirit; added sugar; glycerin and aromatic substances; traces of oak tannin from casks; free acid.
To what does brandy owe its aroma?
What is œnanthic ether chemically, and what is its commercial name?
What is its medicinal use?
Tartaric acid—What is the Latin name? What is it?
How is it prepared?
What is its quantivalence?
Does it contain water of crystallization?
What tartrates are official?
How may they be recognized?
How may tartaric acid be recognized? Describe rationale of test.
Describe its appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Sulphuric acid; oxalic acid; heavy metals; lead.
What official preparations contain tartaric acid?
Citric acid—What is the Latin name? What is it?
How is this acid obtained commercially?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Oxalic acid; tartaric acid; heavy metals; sulphuric acid; lead.
How much water of crystallization does it contain? What class of official preparations are made through the air of this water of crystallization?
What is its quantivalence? What citrates are official and what other official preparations contain citric acid?
What is the dose?
What official preparation is there of it?
What is pectase, and what is pectose?
To what substance do green (unripe) fruits owe their hardness?
In the ripening of fruits, what change takes place whereby the fruits are rendered soft?
When fruit is over-ripe, what substances are produced?

How is the formation of fruit jellies explained?
What action do alkalies have upon pectosic acid and pectin?
Give an illustration of the application of this principle.
Fruit juices—What are these used for?
How may they be prepared?
Rhus glabra—Give origin and description.
To what does it owe its acidity?
How may this acid be obtained from it?
For what is rhus glabra used, and what is the dose?
Blackberries—What is the Latin title and definition?
Give their uses and N. F. preparations.
Raspberries—Give the Latin title and definitions.
What are its uses and N. F. preparation?
Lime juice—What is the Latin title?
How much citric acid should it contain?
What impurities are likely to be present and how detected?
Name its N. F. preparation and use.
Fresh apple juice—Give the Latin title.
What constituent is present and what is its use?
What is tamarind?
What acids are contained in the pulp of tamarinds?
For what is it used?

CHAPTER LV

VOLATILE OILS

Volatile oils, or *essential oils*, are found in the various parts of plants. In some countries they are called *Ætherolea*. They usually constitute the odorous principles, and they either preëxist in the plant, or are produced by the reaction of certain constituents when brought in contact with water. Volatile oils are sometimes formed through destructive distillation, as the oil of amber, and may also be obtained from the animal kingdom, as the oil from ambergris.

The volatile oils are sometimes hydrocarbons, although with these are frequently associated alcohol- or ketone-like bodies called *camphors*, and products of oxidation known under the general name of resins, and undoubtedly formed from the hydrocarbons. Phenols, aldehydes, esters, ethers, and sulphides are also represented. The hydrocarbons are generally known as *terpenes*, from oil of turpentine, which is taken as a type.

Wallach, to whom much of our knowledge of volatile oils is due, divides the hydrocarbons into classes, as follows:

1.—*True terpenes*, of the formula $C_{10}H_{16}$, of which there are two main groups: (*a*), the *terpane* group, uniting with two molecules of haloid acid or four atoms of bromine; this group includes limonene, dipentene, sylvestrene, terpinolene, terpinene, thujene, and phellandrene, their boiling point being between 175° and 185° C. (347° and 365° F.); (*b*), the *camphane* group, uniting with one molecule of haloid acid or two atoms of bromine; this group includes pinene, bornylene, camphene, and fenchene, and they boil between 151° and 161° C. (303.8° and 321.8° F.).

2.—*Hemiterpenes*, of the formula C_5H_8, such as isoprene.

3.—*Polyterpenes*, such as cedrene, cubebene, etc., of the formula $C_{15}H_{24}$ (sesquiterpenes); colophene, of the formula $C_{20}H_{32}$; and caoutchouc, of the formula $(C_{10}H_{16})x$.

Hydrocarbons other than those of the terpene class or derivable from them occur very sparingly in the natural oils. Thus there is of the paraffin series of saturated hydrocarbons, *heptane*, C_7H_{16}, occurring in the oil from the *Pinus sabiniana*, or California *digger pine*, and solid hydrocarbons of the same series in oil of rose, and probably in oils of wintergreen and sweet birch. Of the benzene series there is a single representative in *cymene*, $C_{10}H_{14}$, found in the oils of the Thymus and Monarda species.

In addition to these naturally occurring hydrocarbons, there is a class of artificially prepared hydrocarbons known as *hydroterpenes*, such as dihydrodipentene from dipentene, menthene and carvomenthene from menthol and carvone.

The terpenes in general are practically insoluble in water, but soluble in alcohol, ether, chloroform, benzene, petroleum benzin, and the fixed and volatile oils.

Many of the essential oils, however, owe their essential character and their value to other constituents than hydrocarbons. A brief consideration of the most important of these follows:

I. Alcohols.—*Geraniol, Linalool, Citronellol, Terpineol, Menthol, Borneol, Nerol, Sabinol, Santalol.*

II. Aldehydes.—*Citral, Citronellal, Salicyl Aldehyde, Cumic Aldehyde, Benzaldehyde, Cinnamic Aldehyde, Anisic Aldehyde, Piperonal, Santalal.*

III. Ketones.—*Methyl-amyl-ketone, Iônone, Methyl-nonyl-ketone, Methyl-heptenone, Carvone, Pulegone, Menthone, Camphor, Fenchone, Thujone, Irone.*

IV. Esters.—*Methyl Salicylate, Methyl Anthranilate, Benzyl Acetate, Linalyl Acetate, Geranyl Acetate, Bornyl Acetate, Menthyl Acetate, Bornyl Valerate, Geranyl Tiglate.*

V. Phenols and Phenol Ethers.—*Chavicol, Methyl-chavicol, Anethol, Thymol, Carvacrol, Eugenol, Methyl-eugenol, Iso-eugenol, Chavibetol, Safrol, Iso-safrol, Thymohydroquinone dimethyl ether, Asarol, Apiol, Diosphenol.*

VI. Neutral Bodies, Oxides, etc.—*Cineol (Eucalyptol).*

VII. Sulphides and Sulphur Compounds.—*Diallyl Disulphide, Allyl Isothiocyanate, Dimethyl Sulphide, Butyl Isothiocyanate, Vinyl Sulphide, Acrinyl Isothiocyanate, Phenyl Ethyl Isothiocyanate.*

The classification of the volatile oils in any rational and practical manner is a difficult task.

Any system that is devised is either exceedingly complex and cumbersome or, if conciseness is attempted, there are too many inconsistencies and discrepancies. For instance, one of the favored methods of classification is to divide them into four groups, *i.e.*, the *terpenes, oxygenated oils, nitrogenated oils,* and *sulphurated oils,* but this grouping has defects and, therefore, the foregoing outline has been adopted.

The more important constituents are taken up in groups as follows:

I. Alcohols and Their Esters.—These open chain, unsaturated alcohols, with their esters and aldehydes, play an important part in the composition of many essential oils.

Geraniol, $C_{10}H_{17}OH$, is a colorless liquid of a pleasant rose geranium odor, boiling at 229° to 230° C. (444.2°–446° F.), under ordinary pressure, and at 129° C. (264.2 °F.) under a pressure of 16 mm. Its specific gravity is about 0.881 and its refractive index 1.478. It is optically inactive. By careful oxidation with chromic trioxide, it yields its aldehyde, citral, and by heating it in an autoclave with water to 200° C. (392° F.), it is partly converted into its isomer, linalool. It is a monatomic, primary, open chain alcohol, and is the principal constituent of true geranium (pelargonium) oil, as well as the so-called "Turkish geranium oil," or oil of palmarosa. It is a constituent of rose oil, of citronella oil, and in very small proportions of a number of other oils. Of the esters of geraniol the most important is the *geranyl acetate.* This is a fragrant oil of specific gravity 0.917, boiling at from 128° to 129° C. (262.4°–264.2° F.), under a pressure of 16 mm. It occurs naturally in several essential oils, and can be made artificially by the action of acetic anhydride upon geraniol. Commercial geraniol is also known as *rhodinol.*

Linalool, $C_{10}H_{17}OH$, is known in both of the optically active forms as well as in the inactive. It is a liquid having a pleasant odor, and boils at about 198° C. (388.4° F.). Its specific gravity ranges from 0.868 to 0.877, and its refractive index is 1.463. It is a monatomic, tertiary, open chain alcohol, and is an essential constituent of oil of linalol, and is found in the free state or as an ester in oils of bergamot, coriander, lavender, neroli, etc. The most important of its esters is *linalyl acetate,* which occurs in many essential oils, as in oil of bergamot. It is an odoriferous liquid of the specific gravity 0.912, and boiling at from 105° to 108° C. (221°–226.4° F.) at 11 mm. pressure. It is prepared artificially, and the artificial ester is an important commercial article.

Citronellol, $C_{10}H_{19}OH$, is found in oil of rose and in Spanish geranium oil. It is an odoriferous oil, boiling at from 117° to 118° C. (242.6°–244.4° F.), under a pressure of 17 mm.; specific gravity, 0.8565 at 17.5° C. (63.5° F.); refractive index, 1.457. It is an open chain alcohol closely related to geraniol and is found in oil of rose, oil of geranium, etc. When obtained from oil of rose it is lævogyrate, while when obtained by reducing the aldehyde it is dextrogyrate; in most geranium oils both varieties exist.

A second group comprises the mono-cyclic alcohols, terpineol, which is unsaturated, and menthol, a saturated compound.

Terpineol, or muguet, $C_{10}H_{17}OH$, occurs in liquid and solid modifications, inactive, as well as in the two optically active varieties. Besides occurring naturally it is made artificially by the dehydration of terpin hydrate, and is largely used in the perfume industry because of its lilac odor. It has a sp. gr. of 0.940 at 15° C. (59° F.). Its most important ester is the acetate, which occurs in cajuput and cardamom oils.

Menthol, menthyl alcohol, $C_{10}H_{19}OH$, is official, and will be found described on page 1121.

To a third group of compounds, known as dicyclic, belongs:

Borneol, $C_{10}H_{17}OH$. This compound occurs naturally in both optically active modifications. It also occurs optically inactive. It forms crystalline masses, which, when quite pure, melt at 203° C. (397.4° F.). Borneol can be prepared artificially by reducing its ketone (camphor) with metallic sodium. In this case, however, there results a mixture of borneol and iso-borneol. Borneol forms a number of esters, of which *bornyl acetate* is the most important. This compound melts at 29° C. (84.2° F.), and has a specific gravity of 0.991 at 15° C. (59° F.). It is the characteristic constituent of the pine needle oils.

Nerol is an alcohol discovered in oil of neroli. It is a stereo-isomer of geraniol. Santalol is obtained from oil of sandalwood. It has been given the formula $C_{15}H_{25}OH$, but is probably a mixture of several isomeric or closely related alcohols. *Sabinol,* $C_{10}H_{15}OH$, is a constituent of oil of savin.

Fenchyl alcohol, thujyl alcohol, and *pulegol* all have the same empiric formula as geraniol, $C_{10}H_{17}OH$, do not occur naturally, but are produced from the respective ketones.

II. **Aldehydes.**—Of the alcohols just enumerated, only the first group are primary alcohols, and will yield aldehydes. Thus, from geraniol, there is obtained, by oxidation, citral, the corresponding aldehyde, and from its isomer, linalool, the same.

Citral, $C_9H_{15}COH$. Although at one time called geranial, this compound is now universally known as citral, which indicates its importance in the oils of the *citrus* family. It is obtained most abundantly from lemon grass oil by the aid of the bisulphite process. It is an oily liquid, boiling at from 228° to 230° C. (442.4°–446° F.). Its specific gravity is about 0.89 and its refractive index 1.49. It is optically inactive. Under the influence of alkalies, citral condenses with acetone with the elimination of water to form pseudo-ionone, $C_{13}H_{20}O$, which is converted into its isomer *ionone* by means of acids. Reduction with sodium produces the alcohol geraniol.

Citronellal, $C_9H_{17}OH$, or $C(CH_3)_2CH.CH_2CH_2CH(CH_3)CH_2COH$, the aldehyde of citronellol, occurs in several essential oils, as in citronella oil. It is an oily liquid of characteristic odor; specific gravity 0.8768, refractive index 1.4481. It is dextrogyrate.

Of the class of aromatic aldehydes, the following are found:

Salicyl Aldehyde, $C_6H_4(OH)COH$.—This body is an oily liquid of aromatic odor, boiling at 196° C. (384.8° F.), and having a specific gravity of 1.172. It occurs in the oils of several varieties of *Spiræa.* It can also be formed by the oxidation of its alcohol saligenin, or by the action of chloroform and potassium hydroxide on phenol.

Cumic Aldehyde, $C_6H_4(C_3H_7)COH$.—This is p-isopropyl-benzaldehyde, and is found in several essential oils, as in cumin oil. It is an aromatic oil, having a specific gravity of 0.973, and boiling at 235° C. (455° F.).

Benzaldehyde, $C_6H_5.COH$.—This is now official. (See page 1163.)

Cinnamic Aldehyde, $C_6H_5.CH{:}CH.COH$.—This was official in the U. S. P. VIII. (See page 1140.)

Anisic Aldehyde, $C_6H_4(OCH_3)COH$ (oxymethyl-benzaldehyde), is a synthetic product used in artificial *hawthorn* perfume.

Piperonal or *Heliotropin,* $C_6H_3O_2CH_2COH$, is a synthetic product used in *heliotrope* perfume and as a fixative.

Santalal, $C_{14}H_{23}COH$, is found in sandalwool oil.

III. **Ketones.**—This class of chemical compounds is largely represented in essential oils. Of aliphatic saturated ketones there is only one fairly important representative.

Methyl-nonyl-ketone, $CH_3.CO.C_9H_{19}$, which is found in oil of rue, is a liquid of strong odor, boiling at 225° C. (437° F.), and specific gravity 0.8295 at 17° C. (62.6° F.). It solidifies when cooled, and melts at 13° C. (55.4° F.).

Of aliphatic unsaturated ketones there is also one occurring naturally.

Methyl-heptenone, $CH_3.CO.C_6H_{11}$, is found in lemon grass oil and other oils, and results from the oxidation of citral or the distillation of cineolic anhydride. It has a specific gravity of 0.853 at 20° C. (68° F.) and boils at 174° C. (345.2° F.).

A *methyl-amyl-ketone,* $C_5H_{11}COCH_3$, boiling at 151° C. (303.8° F.) and having a specific gravity of 0.837 at 50° C. (122° F.), is found as a minor constituent in oil of cloves.

The most commonly occurring ketones belong to the cyclic compounds:

Carvone, $C_{10}H_{14}O$.—This compound, found in oils of caraway, fennel and dill, is a colorless oil boiling at 225° C. (437° F.) and having a specific gravity of 0.960 at 18° C. (64.4.° F.). It is optically active, occurring in both forms. Its most interesting addition compound is that with hydrogen sulphide; this is obtained in crystals, decomposing with alcoholic potassium hydroxide and liberating pure carvone. When heated with glacial phosphoric acid, it is changed into the isomeric carvacrol, a phenol compound.

Pulegone, $C_{10}H_{16}O$.—This characteristic ketone of pennyroyal oil is a liquid boiling at 221° C. (429.8° F.), and having a specific gravity of 0.9323 at 20° C. (68° F.). An isomeric body, iso-pulegone, has been obtained artificially.

Menthone, $C_{10}H_{18}O$.—This occurs, along with the corresponding secondary alcohol menthol, in oil of peppermint. It is an oily liquid boiling at 206° C. (402.8° F.), with a specific gravity of 0.897 at 15° C. (59° F.). By the action of oxidizing agents it can be converted into thymol, $C_{10}H_{14}O$.

To the class of dicyclic ketones belong the following isomeric bodies:

Camphor, $C_{10}H_{16}O$.—This most important compound of the ketone class is official, and is described on page 1159.

Fenchone, $C_{10}H_{16}O$.—This ketone occurs as dextro-fenchone in oil of fennel, and as lævo-fenchone in oil of thuja. When purified, it forms an oil of camphoraceous odor, boiling at 193° C. (379.4° F.), and having a specific gravity of 0.9465 at 19° C. (66.2° F.).

Thujone, $C_{10}H_{16}O$.—This ketone is found in oil of thuja, tansy, wormwood and sage, and is identical with the bodies formerly known as *tanacetone* and *salvone*. It is an optically active liquid, boiling at 200° to 203° C. (392°-397.4° F.) and having a specific gravity of 0.9126 at 20° C. (68° F.).

A more complex ketone is:

Irone, $C_{13}H_{20}O$.—The characteristic constituent of orris oil, to which also the violet odor is due. It is an oil almost insoluble in water, but readily soluble in alcohol, boiling at 144° C. (291.2° F.) at 16 mm., and having a specific gravity of 0.939 at 20° C. (68° F.). In the attempt to effect the synthesis of irone, Tiemann and Kruger obtained an isomeric body, *ionone*, from citral, which is now used as the artificial violet odor.

IV. **Acids and Their Esters.**—Of esters of aromatic acids there are several of importance, comprising the most valuable constituents of the oil in which they occur.

Methyl Salicylate is the chief constituent of the oils of wintergreen and sweet birch. It is now official as a pure compound and is described on page 1153.

Methyl Anthranilate (*o-amidobenzoate*), $C_6H_4(NH_2)COOCH_3$.—This is the odoriferous constituent of neroli oil. It is an oil solidifying at low temperatures in crystals, melting at 24.5° C. (76.1° F.), and boiling at 127° C. (260.6° F.) at 11 mm. Its specific gravity is 1.163 at 26° C. (78.8° F.). It is strongly fluorescent and has a powerful neroli odor.

V. **Phenols and Phenol Esters.**—This is an important class, largely represented in the volatile oils. Of monatomic phenols there are:

Chavicol (para allyl-phenol), $C_6H_4(OH)C_3H_5$.—This occurs in the *oil of Chavica Betle,* and is a colorless liquid having a strong odor and a specific gravity of 1.035 at 20° C. (68° F.), boiling at 237° C. (458.6° F.). Still more abundantly formed in nature is its methyl ether, which is:

Methyl-chavicol, $C_6H_4(OCH_3)C_3H_5$.—This occurs in oils of anise, star anise, sweet-basil, bay, etc. It is a colorless liquid of an anise-like odor, boiling at from 215° to 216° C. (419°–420.8° F.), and having a specific gravity of 0.979 at 12° C. (53.6° F.).

Anethol, $C_6H_4(OCH_3)C_3H_5$, is official in the N. F. (see page 1134).

Thymol (methyl-propyl-phenol) is official (see page 1126).

Carvacrol (methyl-propyl-phenol), $C_6H_3.CH_3(OH)C_3H_7 1:2:4$.—This important phenol, occurring in oils of marjoram and savory, is isomeric with thymol. It is a thick oil, solidifying at 0° C. (32° F.) and boiling at 236° C. (456.8° F.). It can be prepared artificially by heating carvone, an isomeric ketone, with phosphoric acid or by heating camphor with iodine.

Of diatomic phenols and their ethers, there are the following:

Eugenol occurs in the oils of clove, allspice, bay, Ceylon cinnamon and cinnamon leaves. It is now official, (see page 1143).

Methyl-eugenol, $C_6H_3.(OCH_3)_2.C_3H_5$, is found with eugenol in oil of bay. It has a specific gravity of 1.041 at 11° C. (51.8° F.) and boils at 248° C. (478.4° F.).

Iso-eugenol is the methyl ether of propenyl-dioxybenzene, and is produced from eugenol when the latter is heated with alcoholic potassium hydroxide. It is used in the manufacture of artificial vanillin.

Chavibetol, $C_9H_8(OCH_3)OH$, is another isomer of eugenol, and occurs with chavicol in oil of betel leaves.

Safrol, $C_6H_3\begin{matrix}O\\O\end{matrix}\!\!>CH_2.C_3H_5$, is the methylene ether of allyl-dioxybenzene. It is found quite largely in the oils of sassafras, camphor, etc. It was official in the U. S. P. VIII (see page 1152).

Iso-safrol is the methylene ether of propenyl-dioxybenzene, and is produced from safrol by heating the latter with alcoholic potassium hydroxide. It is used in the manufacture of *piperonal* (artificial heliotropin).

Thymohydroquinone dimethyl-ether, $C_6H_2.(OCH_3)_2.CH_3.C_3H_7$, constitutes the bulk of the oil of *arnica root.* It is a liquid distilling at from 248° to 250° C. (478.4°–482° F.).

Of triatomic phenols and their ethers, the representative is:

Asarol, $C_6H_2(C_3H_5)(OCH_3)_3$.—This is the trimethyl ether of propenyl-trioxybenzene. It forms the solid constituent of the oil of *Asarum europæum,* and occurs in prisms melting at 61° C. (141.8° F.), and boiling at from 295° to 296° C. (563°–564.8° F.). It has also been made synthetically.

Of tetratomic phenols and their ethers, there is also a representative, as follows:

Apiol, $C_{12}H_{14}O_4$, is the dimethyl-methylene ether of allyl-tetroxybenzene. It occurs in two isomers—the apiol from oil of parsley and dill apiol from some varieties of oil of dill. Of these, the former is a crystalline solid melting at 30° C. (86° F.) and boiling at 294° C. (561.2° F.) and the latter is an oily liquid boiling at 288° C.

(550.4°F.). The oleoresin of parsley fruit, now official in the U. S. P., is often called "apiol." (See page 600.)

VI. **Neutral Bodies, Oxides,** etc.—One important compound of frequent occurrence in volatile oils has not been classified under any of the preceding groups, for the reason that it is relatively inert in a chemical way and is considered as an oxide of neither distinct acid nor basic character.

Cineol (*Eucalyptol*), $C_{10}H_{18}O$.—This is found in nature in large amounts in eucalyptus oil (hence the name "eucalyptol" sometimes given to it), in cajuput oil (hence the name "cajuputol"), in lavender, wormseed, and other oils. It is now official (see page 1148).

VII. **Sulphides and Sulphur Compounds.**—*Di-allyl-disulphide,* $C_6H_{10}S_2$, is a constituent of oil of garlic and occurs in many oils belonging to the *Cruciferæ.* It is a liquid of very unpleasant odor, boiling at 140° C. (284° F.).

Allyl-isothiocyanate, $C_3H_5.NCS$ is the principal constituent of the volatile oil of mustard. It is, however, a decomposition product of the glucoside potassium myronate, which breaks up under the influence of the ferment myrosin. The allyl thiocyanate can also be obtained artificially by distilling allyl iodide or bromide with alcoholic potassium thiocyanate. This artificial product is largely sold in place of the natural oil. It is a liquid having a very unpleasant odor, boiling at 151° C. (303.8° F.), and having a specific gravity of 1.017 at 10° C. (50° F.).

Vinyl sulphide, $(C_2H_3)_2S$, is found in a variety of garlic.

Butyl isothiocyanate, $CH(CH_3)C_2H_5NCS$, is found in oil of horseradish, acrynyl isothiocyanate, C_7H_7ONCS, is found in white mustard, and *phenylethyl isothiocyanate,* $C_2H_4(C_6H_5)NCS$, is found in oil of mignonette.

Color of Volatile Oils.—Most oils are colorless when pure and fresh, or can be made colorless by redistillation. Upon exposure to the air they acquire various colors, becoming green, as in oil of wormwood; yellow, as in oil of peppermint; red, as in oil of origanum; brown, as in oil of cinnamon; or blue, as in oil of chamomile.

Odor.—The odor of volatile oils is very variable. It is their most characteristic feature. It is sensibly modified by the exposure of the oils to the air. Oil of turpentine may be rectified by redistillation in an atmosphere of carbon dioxide, or *in vacuo,* so that it will be odorless, or have an agreeable, fragrant odor. A very slight exposure to the air is sufficient, however, to restore the well-known unpleasant odor.

Taste.—Their taste is almost as variable as their odor. Some are sweet, others have a mild, pungent, hot, acrid, caustic, or burning taste.

Density.—The specific gravity of official volatile oils also varies (from 0.842 to 1.172). They are mostly lighter than water (see table, page 92).

Optical Activity.—This important physical factor is used in determining the purity of many oils. It is explained at length under the U.S.P., Test No. 21, Chapter LXII.

Refractive Index.—This factor is of increasing importance, as it serves as a delicate test chiefly for the purity of oils and fats.

Boiling Point.—This is also variable. The oils volatilize to some extent at ordinary temperatures and diffuse their peculiar odors. Upon heating, however, they may be completely vaporized. When sufficiently heated, they take fire, and burn with a bright flame.

Solubilities.—Water is a poor solvent for volatile oils, although it acquires a decided odor and flavor when brought in contact with the oil in a finely divided state, as we have shown in the medicated waters. Alcohol, ether, chloroform, naphtha, glacial acetic acid, petroleum benzin, and benzene are solvents for volatile oils. Alcohol is a better solvent for the oxygenated oils than for the terpenes. Volatile oils freely dissolve fixed oils, fats, resins, camphors, sulphur, phosphorus, and similar bodies.

Exposure to Light and Air injures the quality and destroys the fragrance of volatile oils. Ozone is developed, and they thicken and become resinified, or deposit crystalline compounds upon exposure. The whitening of corks which have been inserted in bottles containing volatile oils and kept a long time is due to the bleaching action of the ozone which is gradually produced during their decomposition. Volatile oils should be kept in tightly stoppered, amber-colored vials, in a cool place.

Action of Acids, Alkalies, etc.—Nitric acid, if strong, decomposes volatile oils with great rapidity. Iodine reacts with some oils with explosive violence. Alkalies have generally little effect on volatile oils, with the exception of a few with which it forms chemical compounds, like the oil from clove, gaultheria, cinnamon, etc.

Adulterations.—The volatile oils are costly enough to tempt the cupidity of some manufacturers of these products. A fixed oil is sometimes used to mix with the volatile oil. This mixture may be detected by dropping the suspected oil on a piece of filtering paper. The stain of a pure volatile oil is not permanent. By slightly heating it the oil is vaporized; if fixed oil is present, the stain remains. Alcohol may be detected by shaking the mixed oil in a graduated tube with glycerin or water. The volume of the oil will be diminished, and that of the water or glycerin correspondingly increased, in proportion to the amount used. This test is not susceptible of fine determination, because of the slight solubility of volatile oils in water and in mixtures of alcohol and water. Metallic sodium, calcium chloride, aniline red, have all been used to show the presence of alcohol and traces of water in volatile oils. The adulteration of volatile oils by the addition of cheaper grades of the same oil, or by using a cheaper oil having a similar odor, is largely practised. The only reliable test here is the use of the olfactories. By practice the sense of smell can be highly educated by the analyst. The specific rotary power, the index of refraction, the amount of iodine absorbed, and the saponification number, or the amount of potassium hydroxide absorbed by the ester to form a potassium salt, have all been used with more or less success in detecting adulterations. The detection of adulterations in volatile oils is very difficult, and as a rule those who practise this nefarious art are very skilful. The U. S. P. has included a number of assays to indicate the required percentage of the valuable constituents.

Preparation of Volatile Oils

Volatile oils are generally obtained from plants by the following methods: 1. Distillation with steam. 2. Distillation *per se*. 3. Expression. 4. Solution.

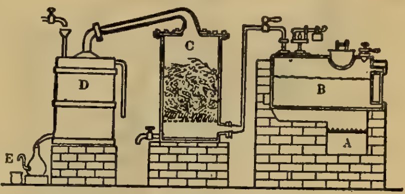
1. **Distillation with Steam.**—This is the method most frequently employed. The general formula is as follows: Put the substance from which the oil is to be extracted into a still (see Distillation, page 160), and add enough water to cover it; then distil by a regulated heat into a large condenser. Separate the distilled oil from the water which comes over with it.

The substances from which the volatile oils are extracted may be employed in either the recent or the dried state. Certain flowers, however, such as orange flowers and roses, must be used fresh, or preserved with salt or by means of glycerin, as they afford little or no oil after desiccation. Dried substances, before being submitted to distillation, require to be macerated in water till they are thoroughly penetrated by this fluid; and, to facilitate the action of the water, it is necessary that, when of a hard or tough consistence, they should be properly comminuted.

The water which is added to the substance to be distilled answers the double purpose of preventing the decomposition of the vegetable matter by regulating the temperature, and of facilitating the volatilization of the oil, which, though in most instances it readily rises with the vapor of boiling water, requires, when distilled alone, a considerably higher temperature, and is at the same time liable to be partly decomposed. Some oils, however, will not ascend readily with steam at 100° C. (212° F.), and in the distillation of these it is customary to use water saturated with common salt, which does not boil under 108.4° C. (227.1° F.) (see page 140). Other oils, again, may be volatilized with water at a temperature below the boiling point; and, as heat exercises an injurious influence over the oils, it is desirable that the distillation should be effected at as low a temperature as possible. To prevent injury from heat, it has been recommended to suspend the substance containing the oil in a basket, or to place it upon a perforated shelf, in the upper part of the still, so that it may be penetrated by the steam without being in direct contact with the water. Another mode of effecting the same object is to distil it *in vacuo*. Steam can be very conveniently applied to this purpose by causing it to pass through a coil of tube, of an inch or three-quarters of an inch bore, placed in the bottom of a common still (see page 145). The end of the tube or steam pipe enters the still at the upper part, and the other end, at which the steam and condensed water escape, passes out laterly below, being furnished with a stop-cock, by which the pressure of the steam may be regulated, and the water drawn off when necessary. In some instances it is desirable to conduct the steam immediately into the still near the bottom, by which the contents are kept in a state of brisk ebullition (see Fig. 112). The distillation of volatile oils is now conducted on a large scale with enormous vacuum stills. (For description and illustrations see Gildemeister and Hoffman on Volatile Oils, translated from the German by Professor E. Kremers.)

The quantity of water added is not a matter of indifference. An amount above that which is necessary acts injuriously by holding the oil in solution when the mixed vapors are condensed; and if the proportion be very large, it is possible that no oil whatever may be separated. On the contrary, if the quantity is too small, the whole of the oil will not be distilled, and there will be danger of the substance in the still adhering to the sides of the vessel and thus becoming burnt. The cage shown on page 178 will be found useful in this connection. Sometimes the quantity of oil is so small that it entirely dissolves in the water, and then the process of *cohobation* is applicable; this consists in repeatedly returning the distillate to a fresh portion of the plant, the water in this way becoming supersaturated, and then the oil can be separated. Fig 448*a* illustrates the ordinary method of distilling volatile oils from plants. *A* shows the fire box, *B* the steam boiler, *C* the tank containing the plant on the slat or perforated bottom, and *D* the condenser.

FIG. 448*a*



Distillation of volatile oils

2. **Distillation** *per se.*—By this is meant the distillation of certain bodies without the use of water (*per se*, "by itself"). This is done in the cases of certain oleoresins, oils, copaiba, etc., water not being required in the process, and always being difficult to separate from the distillate.

3. **Expression** (see page 271).—This method generally produces the most fragrant products, because there are very few volatile oils whose aroma is not injuriously affected by the action of heat. The volatile oils of the Rutaceæ are mostly made by expressing the rind of the fresh fruit (see page 1114).

4. **Solution or Absorption.**—Some volatile oils are so susceptible to decomposition that they are dissociated by distillation, while they do not exist in sufficient quantity in the plant to pay for their extraction by expression. In such cases the odorous principle may be extracted by some form of solution or absorption. This may be effected by maceration, digestion, percolation with carbon disulphide or similar solvent, enfleurage, or the pneumatic process.

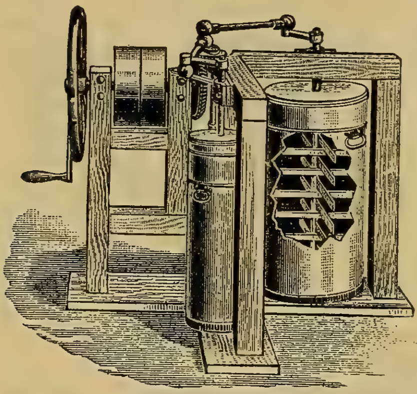
Maceration.—In obtaining volatile oils by maceration, the odorous portions of the plant (generally fragrant flowers) are allowed to stand in contact with a bland, inodorous fixed oil, like fine olive oil, oil of benne, or purified cotton-seed oil; the oil absorbs the odor, and after a certain length of time the oil is strained. The odorous fixed oil is generally used in perfumery.

Digestion.—This process is similar to maceration, except that a moderate heat is employed, by the use of a salt bath, to aid in the extraction.

Enfleurage is largely used for extracting the odors of very delicate flowers. It is a cold process, and consists in spreading a thin layer of purified inodorous fat upon glass frames (*chassis*). These resemble an ordinary window sash, with one pane of glass in each. The flowers are sprinkled on the fat, and the frames piled in a stack. The whole is left undisturbed for a time varying from twelve hours to four days. The fat absorbs the odor completely. When strong pomades are desired, fresh flowers are continually added as long as the absorption continues, and the pomades are known commercially as Nos. 6, 12, 18, and 24, the numbers indicating the strength. The volatile products may be obtained from the pomade by chopping the latter into small pieces and macerating them in pure alcohol. A small portion of the fat is apt to be dissolved by this treatment and give a disagreeable odor to the solution, but this may be separated by subjecting it to a cold atmosphere in a refrigerator, when the congealed fat can be filtered out.

The process of extracting odors from pomades by agitating them in contact with alcohol has been largely used in the United States. The pomades are mostly imported from Grasse, France, and Fig. 449 illustrates Day's pomade washer, a machine constructed for agitating the mixture of pomade and alcohol in order to hasten the process of extraction.

Fig. 449



Day's pomade washer

Pneumatic Process.—This method is used only with very delicate volatile oils. It consists in forcing a current of air into a vessel filled with fresh flowers, and then conveying the perfumed air into another vessel containing purified fat which is kept melted. Circular plates, half immersed, revolve in the fat, and these, when coated, absorb the odor from the perfumed air.

Percolation.—This process consists in percolating odorous flowers with purified carbon disulphide; the latter is distilled, and the volatile oils are found in the residue.

Synthetic Perfumery.—Many of the constituents of volatile oils already enumerated and other alcohols, aldehydes, ketones, esters, etc., are now used for the manufacture of synthetic flower odors. This has become an extensive business and requires chemical substances of a high degree of purity, as minute traces of sulphides or other offensive by-products would render them unfit for use in perfumery.

For the purpose of study the volatile oils are grouped according to Families, as follows:

Official Products from the Rutaceæ

The Family Rutaceæ furnishes valuable products to medicine and pharmacy.

AURANTII AMARI CORTEX. U. S. Bitter Orange Peel

[Aurant. Amar. Cort.]

The dried rind of the fruit of *Citrus Aurantium amara* Linné (Fam. *Rutaceæ*).

Official Description.—In narrow, thin bands (ribbons), or more often elliptical, flattened, more or less curved, pieces (quarters), varying from 3 to 6 cm. in length; outer surface convex, varying from reddish- or yellowish-brown (ribbons) to greenish-brown (quarters), coarsely reticulate and with the edges recurved; inner surface concave, whitish, with numerous conical projections and yellowish-white, linear more or less anastomosing fibro-vascular bundles; fracture hard; transverse section light brown, somewhat spongy, outer layer with 1 or 2 rows of oil reservoirs.

Odor and Taste.—Odor fragrant; taste aromatic and bitter.

Tests for Identity and Purity.—The powder is yellowish white or light brown; fragments of parenchyma cells numerous, the walls from 0.004 to 0.012 mm. in thickness; few fragments of tracheæ with close spiral markings or simple pores; occasional membrane crystals of calcium oxalate in monoclinic prisms, from 0.02 to 0.035 mm. in diameter. Powdered Bitter Orange Peel is colored yellowish upon the addition of potassium hydroxide T.S.

Bitter Orange Peel yields not more than 7 per cent. of ash.

U. S. P. Preparations.—Fluidextractum Aurantii Amari; Tinctura Aurantii Amari; Tinctura Cinchonæ Compositæ; Tinctura Gentianæ Composita.

N. F. Preparations.—Infusum Gentianæ Compositum, Tinctura Amara; Vinum Aurantii Compositum; Vinum Rhei Compositum (from Fluidextract).

The inner thick part of the peel from the bitter orange contains *hesperidin* having the formula $C_{22}H_{26}O_{12}$. This is a glucoside, which yields, on treatment with sulphuric acid, *hesperetin*, $C_{16}H_{14}O_6$, and glucose, $C_6H_{12}O_6$. It also contains a small quantity of volatile oil. It is not used to communicate flavor, but as a bitter tonic. The dose is ten to forty grains (0.65 to 2.6 Gm.).

AURANTII DULCIS CORTEX. U. S. Sweet Orange Peel

[**Aurant. Dulc. Cort.**]

The outer rind of the fresh, ripe fruit of *Citrus Aurantium sinensis* Gallesio (Fam. *Rutaceæ*).

Sweet orange peel owes its virtues to the volatile oil found in the epidermis. It also communicates a yellowish color to the preparations made with it.

Official Description.—The outer, orange-yellow layer recently separated by grating or paring and consisting of epidermal cells, parenchyma cells of the sarcocarp with chromoplastids, oil reservoirs and globules of volatile oil.

Odor and Taste.—Odor highly fragrant; taste pungently aromatic.

U. S. P. Preparations.—Tinctura Aurantii Dulcis; Syrupus Aurantii (from Tincture).

N. F. Preparations.—Elixir Gentianæ Glycerinatum; Elixir Pepsini et Rennini Compositum; Elixir Taraxaci Compositum; Elixir Terpini Hydratis; Vinum Ferri; Vinum Ferri Amarum (all from Tincture).

Uses.—It is used as a flavoring substance. Dose, fifteen grains (1 Gm.).

OLEUM AURANTII. U. S. Oil of Orange

[**Ol. Aurant.**—Oleum Aurantii Corticis, U. S. P. VIII Orange Oil
Oil of Sweet Orange]

A volatile oil obtained by expression from the fresh peel of sweet orange, *Citrus Aurantium sinensis* Gallesio (Fam. *Rutaceæ*), and its varieties. Preserve it in small, well-stoppered, amber-colored bottles, in a cool place, protected from light. Oil of Orange having a terebinthinate odor is not to be dispensed.

This oil consists of *d-limonene* to the extent of at least 90 per cent.; of the remainder, about 5 per cent. are the odorous constituents, among which are *citral*, traces of *citronellal*, and the methyl ester of *anthranilic acid*. It is soluble in alcohol, and may be preserved by shaking it with one-eighth of its volume of distilled water, allowing it to separate, then removing the essential oil, filtering rapidly if necessary, and mixing the filtered oil with 95 per cent. alcohol in the proportion of one volume of the oil to seven volumes of alcohol.

It may also be preserved by adding 10 per cent. of its volume of olive oil. Kept under the usual conditions it is very prone to decompose, and rapidly acquires a terebinthinate odor.

Official Description.—A yellow liquid.

Odor and Taste.—Characteristic odor and taste of orange peel.

Specific Gravity.—0.842 to 0.846 at 25° C. (77° F.).

Tests for Identity and Purity.—Refractive index: 1.4723 to 1.4737 at 20° C. (68° F.) (see U. S. P., Test No. 22, Chapter LXII).

Its optical rotation is not less than +94° in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

Introduce 50 mils of Oil of Orange into a 200-mil, three-bulb Ladenburg flask of approximately the following dimensions: The lower or main bulb 6 cm. in diameter with the smaller condensing bulbs 3.5 cm., 3.0 cm. and 2.5 cm. in diameter, respectively; with the distance from the bottom of the flask to the side arm 20 cm. Then distil the Oil at the rate of one drop per second until 5 mils have been obtained. The angle of rotation of the distillate thus obtained is equal to or only slightly greater than that of the original Oil, and the refractive index of this portion, at 20° C. (68° F.) is not less than 0.0008 nor more than 0.0015 lower than that of the original Oil at 20° C. (68° F.).

U. S. P. Preparations.—Elixir Aromaticum (from Compound Spirit); Spiritus Aurantii Compositus.

N. F. Preparations.—Elixir Cardamomi Compositum (from Compound Spirit); Elixir Ferri Pyrophosphatis, Quininæ et Strychninæ; Elixir Vanillini Compositum (from Compound Spirit); Liquor Ferri Peptonati; Liquor Ferri Peptonati et Mangani; Spiritus Cardamomi Compositus; Spiritus Myrciæ Compositus; Spiritus Vanillini Compositus; Syrupus Quinidinæ; Trochisci Sulphuris et Potassii Bitartratis.

Uses.—It is used as a flavoring agent in elixirs and other preparations.

For the *Oils of Bitter Orange* and *Orange Flowers*, which are official in the N. F., see page 1118.

LIMONIS CORTEX. U. S. Lemon Peel

[Limon. Cort.]

The outer rind of the fresh ripe fruit of *Citrus medica Limonum* (Risso) Hooker filius (Fam. *Rutaceæ*).

Lemon peel is principally used to communicate flavor and color to spirit and syrup of lemon. It contains a volatile oil and *hesperidin*.

Official Description.—The outer, lemon-yellow or dark yellow layer, recently separated by grating or paring and consisting of an epidermal layer, numerous parenchyma cells containing yellow chromoplastids, and large oil reservoirs with globules of the volatile oil.

Odor and Taste.—Odor highly fragrant, distinctive; taste pungent, aromatic.

Tests for Identity and Purity.—Under the microscope, sections of the rind, mounted in a fixed oil, show an epidermal layer composed of small tubular cells, a hypodermal layer containing numerous plastids, a mesocarp with colorless, thin-walled parenchyma and large, elliptical oil reservoirs; parenchyma cells containing a layer of granular protoplasm adhering to the walls and occasionally membrane crystals of calcium oxalate, which are irregularly polygonal in shape, and from 0.015 to 0.025 mm. in diameter.

U. S. P. Preparation.—Tinctura Limonis Corticis.

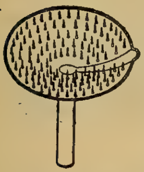
OLEUM LIMONIS. U. S. Oil of Lemon

[Ol. Limon.—LEMON OIL]

A volatile oil obtained by expression from the fresh peel of the ripe fruit of *Citrus medica Limonum* (Risso) Hooker filius (Fam. *Rutaceæ*), and yielding not less than 4 per cent. of the aldehydes from Oil of Lemon, calculated as citral [$C_{10}H_{16}O = 152.13$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light. Oil of Lemon having a terebinthinate odor is not to be dispensed.

This important volatile oil contains a small amount of *pinene*, with dextrogyrate *limonene*, about 7 to 8 per cent. of *citral*, $C_{10}H_{16}O$, an aldehyde yielding geraniol upon reduction, and a small amount of *citronellal*, $C_{10}H_{18}O$, also an aldehyde. Pinene, phellandrene, higher aldehydes as octyl and nonyl, terpineol and geranyl acetate have also been reported in small amounts. Of these the citral is the constituent to which the oil chiefly owes its aroma and value. Citral boils under normal atmospheric pressure at from 228° to 229° C. (442.4°–444.2° F.) without decomposition if pure, and, like aldehydes, forms stable compounds with alkaline bisulphites. Citral is now prepared in commercial quantities, in a pure state, and is recommended for enriching the ordinary oil of lemon. When fresh, the oil has the fragrant odor of lemons. It is soluble in glacial acetic acid, and in all proportions in absolute alcohol. It may be preserved from the effects of oxidation by the addition of 5 per cent. of alcohol and separation from the sediment. This oil is often prepared by expression, although the sponge process is at present largely used. The *ecuelle* (Fig. 450) is a convenient instrument for rapidly rupturing the oil vesicles. It is held in one hand by the operator, while with the other hand the bergamot, lemon, or orange fruit is skilfully rotated on the sharp points. The oil flows into the gutter in the cup, and then through the hollow handle into a suitable vessel.

FIG. 450



Ecuelle

Official Description.—A pale yellow or greenish-yellow liquid.

Odor and Taste.—Characteristic odor and taste of lemon.

Specific Gravity.—0.851 to 0.855 at 25° C. (77° F.).

Refractive index: 1.4744 to 1.4755 at 20° C. (68° F.) (see U. S. P., Test No. 22, Chapter LXII).

The optical rotation varies from +57° to +64° in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

Tests for Identity and Purity.—The angle of rotation of the first 10 per cent. of the distillate, obtained as directed under *Oleum Aurantii*, is not more than 5 degrees less than that of the original Oil. The refractive index of this first 10 per cent. of distillate is not less than 0.002 nor more than 0.0027 lower than that of the original Oil.

Assay.—Introduce about 15 mils of Oil of Lemon into a tared 300-mil flask and note the exact weight; add 10 mils of an alcoholic solution of phenylhydrazine (1 in 10) (not darker in color than pale yellow), and allow it to stand for one-half hour at room temperature. Then add a few drops of methyl orange T.S. and neutralize the liquid exactly by the cautious addition of half-normal hydrochloric acid V.S. If difficulty is experienced in detecting the end point of the reaction, continue the titration until the solution is distinctly acid, transfer it to a separatory funnel and draw off the alcoholic portion. Now wash the Oil with distilled water, adding the washings to the alcoholic solution, and titrate the latter with half-normal potassium hydroxide V.S. Carry out a blank test identical with the foregoing, except that the Oil of Lemon is omitted, and note the amount of half-normal hydrochloric acid V.S. consumed. Subtract the number of mils of half-normal potassium hydroxide V.S. from the number of mils of half-normal hydrochloric acid V.S. consumed in the original test and this result from the corresponding number of mils required in the blank test; each mil of this difference corresponds to 0.076 Gm. of aldehydes, calculated as citral. It shows, when calculated from the weight of Oil taken, not less than 4 per cent. of aldehydes from Oil of Lemon, calculated as citral.

U. S. P. Preparations.—Elixir Aromaticum (from Compound Spirit of Orange); Liquor Magnesii Citratis; Spiritus Ammoniæ Aromaticus; Spiritus Aurantii Compositus.

N. F. Preparations.—Acetum Aromaticum; Linimentum Terebinthinæ Aceticum; Mistura Oleo-Balsamica; Spiritus Odoratus; Syrupus Eriodictyi Aromaticus; Syrupus Sennæ Aromaticus.

Uses.—Oil of lemon is used as a flavoring agent in the official preparations named above.

OLEUM AURANTII AMARI. N. F. Oil of Bitter Orange

[Ol. Aurant. Amar.]

A volatile oil obtained by expression from the fresh peel of the bitter orange, *Citrus Aurantium amara* Linné (Fam. *Rutaceæ*). Preserve it in small, well-stoppered, amber-colored bottles, in a cool place, protected from light. Oil of Bitter Orange having a terebinthinate odor is not to be dispensed.

Official Description.—A pale yellow liquid.

Odor, Taste, and Reaction.—Characteristic, aromatic odor of the Seville orange, and an aromatic, somewhat bitter taste. The alcoholic solution is neutral to litmus paper.

Solubility.—Soluble in 4 volumes of alcohol. Also soluble in all proportions in dehydrated alcohol and in an equal volume of glacial acetic acid.

Specific Gravity.—0.842 to 0.848 at 25° C. (77° F.).

Tests for Identity and Purity.—It is dextrorotatory, the angle of rotation varying from + 92° to + 98°, in a 100-mm. tube, at 25° C. (77° F.).

Introduce 50 mils of Oil of Bitter Orange into a 200-mil, three-bulb, fractionating flask. Distil the Oil at the rate of 2 mils per minute until a distillate measuring 5 mils has been collected. The angle of rotation of this distillate is equal to, or only slightly lower than, that of the original Oil.

N. F. Preparation.—Elixir Aurantii Amari.

Uses.—It is used as an adjuvant and flavor. The dose is three minims (0.2 mil).

OLEUM AURANTII FLORUM. N. F. Oil of Orange Flowers

[Ol. Aurant. Flor. OIL OF NEROLI]

A volatile oil distilled from the fresh flowers of the bitter orange, *Citrus Aurantium amara* Linné (*Citrus vulgaris* Risso, *Citrus Bigaradia* Risso) (Fam *Rutaceæ*). Preserve it in small, amber-colored, well-stoppered bottles, in a cool place, protected from light.

Official Description.—A pale yellow, slightly fluorescent, neutral liquid.

Odor, Taste, and Reaction.—A distinctive fragrant odor similar to that of orange blossoms and an aromatic, at first sweet then somewhat bitter taste. The alcoholic solution is neutral to litmus paper.

Solubility.—Soluble in an equal volume of alcohol, the solution having a violet fluorescence. Also soluble in two volumes of 80 per cent. alcohol, the solution becoming cloudy on the further addition of alcohol of the same percentage.

Specific Gravity.—0.868 to 0.880 at 25° C. (77° F.).

Tests for Identity and Purity.—It is dextrorotatory, the angle of rotation varying from + 1° 30′ to + 5° in a 100-mm. tube, at 25° C. (77° F.).

When agitated with a concentrated solution of sodium bisulphate, it assumes a permanent purple-red color.

N. F. Preparation.—Spiritus Odoratus.

Uses.—It is used as a flavor in perfumes, it being the dominant odor in Cologne water.

OLEUM BERGAMOTTÆ. N. F. Oil of Bergamot
[Ol. Bergam.]

A volatile oil obtained by expression from the rind of the fresh fruit of *Citrus Aurantium Bergamia* (Risso et Poiteau) Wight et Arnott (Fam. *Rutaceæ*), and containing not less than 36 per cent. of ester, calculated as linalyl acetate. Preserve it in small, amber-colored, well-stoppered bottles, in a cool place, protected from light.

Official Description.—A green or greenish-yellow liquid, neutral or only faintly acid.

Odor and Taste.—A characteristic fragrant odor and an aromatic bitter taste.

Solubility.—Two volumes of the Oil, when mixed with 1 volume of alcohol, give a clear solution and this does not become turbid on the furthur addition of alcohol. It is soluble in 2 volumes of 80 per cent. alcohol with not more than a slight cloudiness, and no separation of oil globules. Also soluble in all proportions in glacial acetic acid.

Specific Gravity.—0.875 to 0.880 at 25° C. (77° F.).

Tests for Identity and Purity.—It is dextrorotatory, the angle of rotation varying from $+8°$ to $+24°$, in a 100-mm. tube, at 25° C. (77° F.).

Fixed Oils.—Evaporate in a tared dish on a water bath about 2 Gm. of the Oil, accurately weighed, until the odor has completely disappeared; a soft green residue remains, corresponding to not more than 6 per cent. of the Oil.

Chlorinated Compounds.—To 2 Gm. of Oil of Bergamot add 10 mils of alcoholic potassium hydroxide V.S., free from chloride, evaporate to dryness and incinerate. Extract the ash with distilled water and acidify with diluted nitric acid; no cloudiness is produced on the addition of silver nitrate T.S.

Assay.—To 2 Gm. of the Oil add 20 mils of half-normal alcoholic potassium hydroxide V.S. and heat the mixture in a flask on a water bath, under a reflux condenser, for a half hour. Cool the mixture, add 100 mils of distilled water and titrate with half-normal sulphuric acid V.S., using phenolphthalein T.S. as indicator. Not more than 12.6 mils of half-normal sulphuric acid V.S. is required, corresponding to not less than 36 per cent. of ester, calculated as linalyl acetate, in the Oil. Each mil of half-normal potassium hydroxide V.S. consumed corresponds to 0.09808 Gm. of ester, calculated as linalyl acetate.

N. F. Preparation.—Spiritus Odoratus.

Uses.—Used as a perfume chiefly in oils and pomades for the hair.

Official Products from the Labiatæ

The family of the mints is a strongly marked group, the members of it being remarkable for their botanical analogy with one another and for the similarity of their chemical constituents.

MENTHA PIPERITA. U. S. Peppermint
[Menth. Pip.]

The dried leaves and flowering tops of *Mentha piperita* Linné (Fam. *Labiatæ*).

Official Description.—Leaves more or less crumpled and frequently detached from the stems; stems quadrangular, from 1 to 2 mm. in diameter, glabrous except for a few scattered deflexed hairs; leaves when entire ovate-oblong to oblong-lanceolate, petioles from 4 to 15 mm. in length, slightly pubescent, laminæ from 1 to 9 cm. in length, acute and sharply serrate, light green to purplish-brown, upper surfaces nearly glabrous, lower surfaces glandular hairy, especially on the veins; flower-whorls in oblong or oval spikes which are usually compact, or somewhat interrupted at the base, from 1 to 1.5 cm. in breadth, rounded at the summit, and in fruit attaining a length of from 3 to 7 cm.; bracts oblong-lanceolate, very acuminate, 7 mm. in length; calyx tubular, equally 5-toothed, pubescent and glandular-punctate, often dark purple in color; corolla tubular-campanulate, 4-cleft, about 3 mm. in length and often light purple; stamens 4, short and equal; nutlets ellipsoidal, about 0.5 mm. in diameter, blackish-brown.

Odor and Taste.—Odor aromatic, characteristic; taste aromatic, pungent, followed by a cooling sensation in the mouth.

U. S. P. Preparation.—Spiritus Menthæ Piperitæ.

Uses.—Its properties are due to the presence of about 2 per cent. of a volatile oil. It is largely cultivated, and is a grateful aromatic stimulant. It is used in making spirit of peppermint. The dose is one drachm (4 Gm.).

OLEUM MENTHÆ PIPERITÆ. U. S. Oil of Peppermint

[Ol. Menth. Pip.—PEPPERMINT OIL]

A volatile oil distilled from the flowering plant of *Mentha piperita* Linné (Fam. *Labiatæ*), rectified by steam distillation, and yielding not less than 5 per cent. of esters, calculated as menthyl acetate [$C_{10}H_{19}C_2H_3O_2 = 198.18$], and not less than 50 per cent. of total menthol [$C_{10}H_{19}OH = 156.16$], free and as esters. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

This is one of the most important of the group of volatile oils. It has been shown to contain the following constituents: acetaldehyde, isovaleraldehyde, dimethyl sulphide, amyl alcohol, isovaleric acid, pinene, phellandrene, cineol, limonene, *menthone*, $C_{10}H_{18}O$, menthol, the acetate and isovalerate of menthyl, *a-lactone*, $C_{10}H_{16}O_2$, and cadinene. Menthol, its oxidation product menthone, and the acetic and isovaleric esters of menthyl have been identified as present in English and French peppermint oils, which probably also contain most of the other constituents mentioned above. Menthol and its esters are regarded as the main constituents of oil of peppermint. The dimethyl sulphide and some of the other constituents are objectionable from the flavoring standpoint, and are largely removed by the steam distillation which is required for rectification. The polariscope has been shown to be an uncertain guide in determining the quality of oil of peppermint. It is distilled in large quantities in Michigan, Ohio, Indiana, and New York from cultivated plants. *Menthol* is official, and the proportion which should be present forms the basis of the official assay (see below). Dementholated oil is often found in the market.

Official Description.—A colorless liquid.

Odor and Taste.—It has a strong odor of peppermint, and a pungent taste, followed by a sensation of cold when air is drawn into the mouth.

Solubility.—Soluble in 4 volumes of 70 per cent. alcohol, showing not more than slight opalescence and no separation of oil globules.

Specific Gravity.—0.896 to 0.908 at 25° C. (77° F.).

The optical rotation varies between $-23°$ and $-33°$ in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

Tests for Purity.—*Dimethyl Sulphide found in Non-rectified Oils.*—Distil about 1 mil from 25 mils of the Oil and pour the distillate on 5 mils of mercuric chloride T.S.; a white film does not form at the zone of contact within one minute.

Assay for Esters.—Introduce 10 mils of Oil of Peppermint into a tared flask and note the exact weight. Add 25 mils of half-normal alcoholic potassium hydroxide V.S., connect the flask with a reflux condenser, and boil the mixture during one hour. After cooling, titrate the residual alkali with half-normal sulphuric acid V.S., using phenolphthalein T.S. as indicator. Subtract the number of mils of half-normal sulphuric acid V.S. required from the 25 mils of half-normal alcoholic potassium hydroxide V.S. taken, multiply the difference by 9.909, and divide the product by the weight of the Oil of Peppermint taken to find the percentage of menthyl acetate.

Assay for Total Menthol.—Introduce 10 mils of the Oil into a flask provided with a ground-glass tube-condenser (acetylization flask), add 10 mils of acetic anhydride and about 1 Gm. of powdered anhydrous sodium acetate, and boil the mixture gently during one hour. Allow it to cool, wash the acetylized oil with distilled water, and afterwards with sodium carbonate T.S., diluted with an equal volume of distilled water, until the mixture is slightly alkaline to phenolphthalein T.S., and then dry it with the aid of fused calcium chloride, and filter. Transfer 5 mils of the dry acetylized oil to a tared 100-mil flask, note the exact weight, add 50 mils of half-normal alcoholic potassium hydroxide V.S., connect the flask with a reflux condenser, and boil the mixture during one hour. After cooling, titrate the residual alkali with half-normal sulphuric acid V.S., using phenolphthalein T.S. as indicator, and calculate the percentage of menthol present by the following formula:

$$\text{Percentage of menthol} = \frac{A \times 7.808}{B - (A \times 0.021)}$$

In which A is the result obtained by subtracting the number of mils of half-normal sulphuric acid V.S. required in the above titration from the number of mils of half-normal alcoholic potassium hydroxide V.S. originally taken, and B is the weight of acetylized oil taken.

U. S. P. Preparations.—Aqua Menthæ Piperitæ; Pilulæ Rhei Compositæ; Spiritus Menthæ Piperitæ.

N. F. Preparations.—Acetum Aromaticum; Cataplasma Kaolini; Elixir Catharticum Compositum (from Spirit); Elixir Phosphori (from Spirit); Gargarisma Guaiaci Composita; Linimentum Opii Compositum; Liquor Antisepticus Alkalinus; Mistura Carminativa; Mistura Chloroformi et Morphinæ Composita; Mistura Olei Picis; Mistura Opii et Rhei Composita (from Spirit); Mistura Rhei Alkalina (from Spirit); Mistura Rhei Composita (from Spirit); Oleum Hyoscyami Compositum; Pilulæ Catharticæ Vegetabiles; Syrupus Ficorum Compositus (from Spirit); Trochisci Menthæ Piperitæ.

Uses.—Oil of peppermint is used as a stimulant and carminative in the dose of three minims (0.2 mil) and as an ingredient in the official preparations listed above.

MENTHOL. U. S. Menthol

A secondary alcohol [$C_{10}H_{19}OH = 156.16$] obtained from oil of peppermint or other mint oils. Preserve it in well-closed containers, in a cool place.

The oil of peppermint owes its odor to *menthol* ($C_{10}H_{20}O$), a stearoptene obtained from it through fractional distillation, cooling, and crystallization.

Official Description.—It occurs in colorless, acicular or prismatic crystals.

Odor and Taste.—A strong odor and taste of peppermint; when tasted it produces a sensation of warmth, followed by cold when air is drawn into the mouth.

Solubility.—Slightly soluble in water; very soluble in alcohol, chloroform, ether or in petroleum benzin; freely soluble in liquid petrolatum or fixed or volatile oils.

Tests for Identity and Purity.—Its alcoholic solution is neutral to litmus, and is lævorotatory.

It melts between 42° and 44° C. (107.6° and 111.2° F.).

When Menthol is triturated with about an equal weight of camphor, thymol, or hydrated chloral, the mixture becomes liquid.

Wax, Paraffin, or Inorganic Substances.—Heat about 2 Gm. of Menthol in an open dish, on a water bath; it gradually volatilizes without leaving more than 0.05 per cent. of residue.

Thymol.—Dissolve a few crystals of Menthol in 1 mil of glacial acetic acid and then add 3 drops of sulphuric acid and 1 drop of nitric acid; no green color is produced.

N. F. Preparations.—Inunctum Mentholis; Inunctum Mentholis Compositum; Liquor Antisepticus; Liquor Pepsini Antisepticus; Menthol Camphoratum; Nebula Aromatica; Nebula Mentholis; Nebula Mentholis Composita; Petroxolinum Mentholis; Pulvis Antisepticus.

Uses.—Menthol is largely used, compressed into cones, as a local remedy in neuralgia and headache and as a constituent in solutions for nasal and throat sprays, etc.

MENTHOL CAMPHORATUM. N. F. Camphorated Menthol

[**Menthol. Camph.**—CAMPHO-MENTHOL, N. F. III CAMPHOR AND MENTHOL]

	Metric	Old form
Camphor	47.5 Gm.	1 oz. av. 394 gr.
Menthol	47.5 Gm.	1 oz. av. 394 gr.
Alcohol	5.0 Gm.	87 gr.
To make	100 Gm.	4 oz. av.

Reduce the camphor to a powder by triturating it with about one-tenth of its weight of menthol, then add the rest of the menthol and continue trituration until the mixture is completely liquefied; finally add the alcohol.

Camphorated Menthol may also be prepared by placing the camphor and menthol in a suitable bottle, tightly stoppering it and partially immersing it in hot water until, after occasional agitation, the mixture is completely liquefied, and finally adding the alcohol.

Uses.—An antiseptic and deodorant; employed externally.

MENTHA VIRIDIS. U. S. Spearmint

[Menth. Vir.]

The dried leaves and flowering tops of *Mentha spicata* Linné (*Mentha viridis* Linné) (Fam. *Labiatæ*).

Official Description.—Leaves more or less crumpled and mixed with a large proportion of the light brown or purplish-colored stems, occasionally with their characteristic opposite branches; stems distinctly quadrangular, from 1 to 3 mm. in width, nearly glabrous; leaves when entire ovate-lanceolate, unequally serrate, nearly sessile or with a petiole less than 5 mm. in length, of a bright green color and somewhat glandular-hairy on the under surface: flowers arranged in opposite clusters and in more or less interrupted or crowded lanceolate, nearly acute spikes; bracts linear-lanceolate, subulate, from 7 to 10 mm. in length, subtending the flower clusters; calyx tubular, 5-toothed, glandular punctate and somewhat pubescent near the teeth; corolla nearly white or light brown; stamens extending beyond the corolla tube.

Odor and Taste.—Odor slightly pungent, characteristic; taste aromatic, characteristic but not followed by a cooling sensation in the mouth.

U. S. P. Preparation.—Spiritus Menthæ Viridis.

The volatile oil is the only constituent of importance in this plant; the yield is from ½ to 1 per cent. The dose is one drachm (4 Gm.).

OLEUM MENTHÆ VIRIDIS. U. S. Oil of Spearmint

[Ol. Menth. Vir.—Spearmint Oil]

A volatile oil distilled from the flowering plant of *Mentha spicata* Linné (*Mentha viridis* Linné) (Fam. *Labiatæ*), and yielding not less than 43 per cent., by volume, of carvone [$C_{10}H_{14}O = 150.11$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

The German and American oil of spearmint also contains a terpene, *L. limonene*, $C_{10}H_{16}$, and *L. carvone*, $C_{10}H_{14}O$, the latter in the amount of from 35 to 56 per cent. The Russian oil has been found to contain from 5 to 10 per cent. of carvone only, but 50 to 60 per cent. of linalool, together with some cineol and *L. limonene.*

Official Description.—A colorless, yellow or greenish-yellow liquid.

Odor and Taste.—Characteristic odor and taste of spearmint.

Solubility.—Soluble in 1 volume of 80 per cent. alcohol, forming a clear solution; on further dilution, it usually becomes cloudy.

Specific Gravity.—0.917 to 0.934 at 25° C. (77° F.).

Tests for Identity.—The optical rotation varies between $-38°$ and $-55°$ in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

Assay.—Proceed as directed under *Oleum Cari*, using 10 mils of Oil of Spearmint.

U. S. P. Preparations.—Aqua Menthæ Viridis; Spiritus Menthæ Viridis.

Uses.—It is used as a stimulant and carminative in doses of three minims (0.2 mil), and extensively as a flavor, especially in chewing gum.

OLEUM LAVANDULÆ. U. S. Oil of Lavender

[**Ol. Lavand.**—Oleum Lavandulæ Florum, U. S. P.VIII. Oil of Lavender Flowers]

A volatile oil distilled from the fresh flowering tops of *Lavandula vera* De Candolle (*Lavandula officinalis* Chaix, *Lavandula spica* Linné) (Fam. *Labiatæ*). Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

Oil of lavender flowers is most largely used in perfumery. The best quality is distilled at Mitcham, England. It has the same composition and properties as oil of lavender. It is, however, more fragrant and more expensive. The principal constituent of the oil is an alcohol, $C_{10}H_{18}O$, identical with the linalool. This alcohol boils at from 197° to 199° C. (386.6°–390.2° F.), and has a sp. gr. of 0.869 at 20° C. (68° F.). Besides linalool, lavender oil contains *linalyl acetate* (from 30 to 45 per cent. in the oil from French flowers, and from 7 to 10 per cent. in the oil from English flowers), the *butyric ester* of the same alcohol, *geraniol*, a very small amount of *cineol* (more in the English than in the French oil), and sometimes traces of pinene, limonene, and a sesquiterpene.

Oil of Spike Lavender is an inferior grade of lavender oil and should not be used in perfumery.

Official Description.—A colorless or yellow liquid.

Odor and Taste.—Characteristic odor and taste of lavender flowers.

Solubility.—Soluble in 3 volumes of 70 per cent. alcohol.

Specific Gravity.—0.875 to 0.888 at 25° C. (77° F.).

Tests for Identity and Purity.—The optical rotation varies from −1° to −10° in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

Alcohol.—When shaken in a narrow glass cylinder with an equal volume of distilled water, its volume does not diminish.

Foreign Esters.—Shake 20 mils of the Oil with 40 mils of 5 per cent. alcohol and, when the mixture has cleared, withdraw 30 mils of the alcoholic solution. Neutralize this with half-normal potassium hydroxide V.S., using phenolphthalein T.S. as indicator, then add 5 mils of half-normal potassium hydroxide V.S. and heat the mixture on a water bath, under a reflux condenser, during one hour. Not less than 4.7 mils of half-normal hydrochloric acid V.S. is required for neutralization.

U. S. P. Preparations.—Linimentum Saponis Mollis; Spiritus Ammoniæ Aromaticus; Spiritus Lavandulæ; Tinctura Lavandulæ Composita; Unguentum Diachylon.

N. F. Preparations.—Acetum Aromaticum; Linimentum Ammonii Iodidi; Mistura Ferri Composita (from Spirit); Mistura Oleo-Balsamica; Oleum Hyoscyami Compositum; in all Petroxolins; Spiritus Odoratus.

Uses.—It is used as a stimulant and aromatic. Dose, three minims (0.2 mil).

OLEUM ROSMARINI. U. S. Oil of Rosemary

[**Ol. Rosmar.**—Rosemary Oil]

A volatile oil distilled from the fresh flowering tops of *Rosmarinus officinalis* Linné (Fam. *Labiatæ*), yielding not less than 2.5 per cent. of ester, calculated as bornyl acetate [$C_{10}H_{17}C_2H_3O_2 = 196.16$], and not less than 10 per cent. of total borneol [$C_{10}H_{17}OH = 154.14$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

This oil principally consists of *pinene*, of the composition $C_{10}H_{16}$, boiling at 165° C. (329° F.), but there is a smaller fraction boiling at from 200° to 210° C. (392°–410° F.), which at low temperatures deposits a camphor, $C_{10}H_{18}O$, identified as borneol. *Cineol* ($C_{10}H_{18}O$) has also been separated from a fraction boiling between 176° and 182° C. (348.8° and 359.6° F.). The oil is therefore recognized at present as containing d-pinene, camphene, cineol, borneol (10–15 per cent.), and camphor. This oil is stimulant, but is employed chiefly as an ingredient in rubefacient liniments. For a case of fatal poisoning, see *A. J. P.*, xxiii, 286.

Official Description.—A colorless or pale yellow liquid.
Odor and Taste.—Characteristic odor of rosemary, and a camphoraceous taste.
Solubility.—Soluble in 10 volumes of 80 per cent. alcohol.
Specific Gravity.—0.894 to 0.912 at 25° C. (77° F.).
Assay for Esters and Total Borneol.—Proceed as directed for menthyl acetate and for menthol under *Oleum Menthæ Piperitæ*, using 10 mils of Oil of Rosemary for each assay. In place of the factor and formula for menthyl acetate and menthol, respectively, under *Oleum Menthæ Piperitæ* use the factor 9.808 in calculating the percentage of bornyl acetate and the following formula in calculating the percentage of borneol.

$$\text{Percentage of borneol} = \frac{A \times 7.707}{B-(A \times 0.021)}$$

In which A is the result obtained by subtracting the number of mils of half-normal sulphuric acid V.S. required in the titration from the number of mils of half-normal alcoholic potassium hydroxide V.S. originally taken, and B is the weight of acetylized oil taken.

U. S. P. Preparations.—Linimentum Chloroformi (from Soap Liniment); Linimentum Saponis; Tinctura Lavandulæ Composita.

N. F. Preparations.—Acetum Aromaticum; Linimentum Ammonii Iodidi; Linimentum Saponato Compositum; Oleum Hyoscyami Compositum; Spiritus Odoratus.

Uses.—It is used chiefly as a stimulant in rubefacient liniments. It may be given in doses of three minims (0.2 mil).

THYMUS. N. F. Thyme

The dried tops of *Thymus vulgaris* Linné (Fam. *Labiatæ*), collected when the plant is in flower.

This drug is the source of the official oil of thyme, which is the chief constituent. Tannin and resin are also present.

Official Description.—Stems quadrangular, about 0.5 mm. in diameter, grayish brown or purplish in color, pubescent, nodes from 5 to 20 mm. apart, occasionally with the opposite leaves attached; leaves linear, linear-lanceolate, or ovate-oblong, from 0.5 to 4 mm. in length and from 0.5 to 2 mm. in breadth, summit acute, base obtuse, tapering into a petiole from 0.5 to 2 mm. in length, margin revolute, upper surface grayish-green, puberulent, with numerous one-celled, thick-walled, non-glandular hairs; lower surface grayish, pubescent, with non-glandular, one- to four-celled, thick-walled, rough simple hairs, up to 0.135 mm. in length and usually curved at the first joint in the bases; numerous compound glandular secreting hairs, with short one-celled stalk occurring chiefly on the upper surface and depressed in the cuticle, which give the leaf a glandular-punctate appearance; inflorescence in about twelve-flowered axillary whorls; flowers polygamous, calyx tubular, about 4 mm. in length, ovoid or slightly curved on the lower side near the base, from nine- to twelve-nerved, pubescent, the throat bearded with longitudinally striated, straight simple hairs up to 1 mm. in length, bilabiate, upper lip three-toothed, lower lip with two hairy, ascending, attenuated divisions, corolla about twice as long as the calyx, purplish, smooth within, slightly pubescent without, upper lip emarginate, lower spreading and three-lobed, stamens slightly didynamous and exserted, stigma bifid; nutlets about 0.5 mm. in diameter, spheroidal and finely tuberculate.

Odor and Taste.—Odor agreeable, aromatic; taste aromatic and warming.

Tests for Identity and Purity.—Thyme yields not more than 14 per cent. of ash.

N. F. Preparation.—Fluidextractum Thymi.

Uses.—As a carminative, emmenagogue, and antispasmodic in doses of one drachm (4 Gm.).

OLEUM THYMI. U. S. Oil of Thyme

[Ol. Thymi—THYME OIL]

A volatile oil distilled from the flowering plant of *Thymus vulgaris* Linné (Fam. *Labiatæ*), and containing not less than 20 per cent., by volume, of phenols. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

The oil, as prepared in the south of France, is known commercially as *oil of origanum.* It is, after one distillation, of a reddish-brown color, and is called the *red oil,* but when again distilled is colorless, and in this condition is distinguished as the *white oil.* The specific gravity of the red or common oil is stated at 0.905, but probably varies, as the oil is a complex body. The more volatile portion, that coming over below 180° C. (356° F.) in distillation, is a mixture of *cymene,* $C_{10}H_{14}$, boiling at 175°C. (347°F.), and *pinene,* $C_{10}H_{16}$, boiling at 161° C. (321.8° F.). The less volatile and most valuable portion is chiefly *thymol,* $C_{10}H_{14}O$, a white crystalline solid, melting at 50° C. (122° F.), and possessing a pungent taste. *Carvacrol* is also present, at times replacing part or all of the thymol, and in addition *linalool* and *bornyl acetate* have been found in small amount. This substance is also found in oil of monarda (horsemint). (See Thymol, page 1126.)

Official Description.—A colorless or red liquid.

Odor and Taste.—Characteristic odor and taste.

Solubility.—Soluble in 2 volumes of 80 per cent. alcohol.

Specific Gravity.—0.894 to 0.930 at 25° C. (77° F.).

Tests for Identity.—It is slightly lævorotatory.

Shake 1 mil of the Oil with 10 mils of hot distilled water, and, after cooling, pass the aqueous layer through a wetted filter; the filtrate does not assume a blue or violet color upon the addition of a drop of ferric chloride T.S.

Assay.—Introduce 75 mils of sodium hydroxide T.S. into a flask with a long graduated neck (cassia flask), add 10 mils of the Oil to be assayed, stopper the flask tightly, shake the mixture thoroughly, and set it aside for from twelve to twenty-four hours. Then add sufficient sodium hydroxide T.S. to raise the lower limit of the oily layer within the graduated portion of the neck of the flask, and, after the alkaline solution has become clear, adjust it to the temperature at which it was measured, and note the volume of the residual liquid. This measures not more than 8 mils, indicating the presence of not less than 20 per cent., by volume, of phenols.

N. F. Preparations.—Linimentum Saponato-Camphoratum; Liquor Antisepticus; Liquor Zinci et Alumini Compositus; Liquor Zinci et Ferri Compositus; Mistura Oleo-Balsamica; Oleum Hyoscyami Compositum.

Uses.—Oil of thyme or *oil of origanum,* as it is usually called, is largely used in liniments as a stimulant. The official preparations are given above.

THYMOL. U. S. Thymol

A phenol [$C_{10}H_{14}O$ or $C_6H_3(CH_3)(OH)(C_3H_7)$ 1:3:4 = 150.11] occurring in the volatile oil of *Thymus vulgaris* Linné (Fam. *Labiatæ*) and some other volatile oils. Preserve it in well-closed containers.

Preparation.—Thymol has been made synthetically and is obtained from the volatile oils of several plants by fractional distillation, by which terpenes are separated. The portion distilling above 190° C. (374° F.) is collected, agitated with solution of sodium hydroxide to separate more of the terpenes, and cooled; the compound of thymol with sodium hydroxide is then decomposed by hydrochloric acid. Thymol is recrystallized from an alcoholic solution. It has been obtained from *Monarda didyma* Linné, *M. punctata*, *Ammi copticum*, *Ocymum basilicum*, and *Ptychotis ajowan*. The phenol of the oil of *Thymus serpyllum* Linné closely resembles thymol, but differs from it in not congealing at 10° C. (50° F.), in its solution in diluted alcohol turning green with ferric chloride, and in the potassium salt with its sulpho-acid being amorphous.

Official Description.—It occurs in large, colorless, translucent, rhombic prisms. As a solid it is heavier than water, but when liquefied by fusion it is lighter than water.

Odor, Taste, Reaction, and Rotation.—It has an aromatic, thyme-like odor, and a pungent, aromatic taste, with a very slight caustic effect upon the lips. Its alcoholic solution (1 in 20) is neutral to litmus and is optically inactive.

Solubility.—One Gm. of Thymol dissolves in 1010 mils of water, about 1 mil of alcohol, 0.7 mil of chloroform, 1.5 mils of ether, and in 1.7 mils of olive oil at 25° C. (77° F.); soluble in glacial acetic acid or in fixed or volatile oils.

Tests for Identity and Purity.—It melts between 48° and 51° C. (118.4° and 123.8° F.), remaining liquid at a considerably lower temperature.

When it is triturated with about an equal weight of camphor or menthol, the mixture liquefies.

When a very small crystal of Thymol is dissolved in 1 mil of glacial acetic acid, and then 6 drops of sulphuric acid and 1 drop of nitric acid are added, the liquid assumes a deep bluish-green color by reflected light.

Heat about 1 Gm. of Thymol in a test tube in a water bath with 5 mils of a 10 per cent. solution of sodium hydroxide; a clear, colorless, or pale red solution is formed, which becomes darker on standing, without the separation of oily drops. Upon the addition of a few drops of chloroform to this solution and agitating the mixture, a violet color is produced.

Volatilize about 2 Gm. of Thymol on a water bath; not more than 0.05 per cent. of residue remains.

Phenol.—An alcoholic solution of Thymol (1 in 20) is not colored violet by ferric chloride T.S.

N. F. Preparations.—Cataplasma Kaolini; Liquor Antisepticus; Liquor Antisepticus Alkalinus; Nebula Aromatica; Nebula Thymolis; Petroxolinum Sulphuratum Compositum; Pulvis Antisepticus.

Uses.—Thymol is a valuable antiseptic, and may be used for the same purposes as phenol. It liquefies if triturated with an equal amount of hydrated chloral, menthol, or camphor, and some other substances. Dose, as an antiseptic, is two grains (0.12 Gm.), as an anthelmintic, fifteen grains (1 Gm.). It is also given internally in large doses (15 grains or more), to expel intestinal parasites. especially the hookworm.

THYMOLIS IODIDUM. U. S. Thymol Iodide

[Thymol. Iod.]

Chiefly dithymol-diiodide [$C_{20}H_{24}O_2I_2$ or $(C_6H_2.CH_3.C_3H_7.OI)_2$ = 550.03]. It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 43 per cent. of iodine (I = 126.92). Preserve it in well-closed containers, protected from light.

Preparation.—It may be made by adding to 15 parts of thymol and 16 parts of sodium hydroxide in 300 parts of water a solution of 60 parts of iodine and 80 parts of potassium iodide in water to make 300 parts. The resulting precipitate is washed and dried at 50° C. (122° F.).

Official Description.—A reddish-brown or reddish-yellow bulky powder.

Odor.—It has a very slight, aromatic odor.

Solubility.—Thymol Iodide is insoluble in water or glycerin; slightly soluble in alcohol at 25° C. (77° F.); readily soluble in chloroform, ether, collodion or in fixed or volatile oils, leaving a slight residue.

Tests for Identity.—It is not soluble in solution of sodium hydroxide, either cold or warm. When heated with concentrated sulphuric acid, it is decomposed with the separation of iodine.

Impurities and Tests for Impurities.—Dried to constant weight in a desiccator over sulphuric acid, it loses not more than 5 per cent. of its weight.

Incinerate about 0.5 Gm. of Thymol Iodide in a porcelain crucible at a temperature not exceeding a low red heat; not more than 1.5 per cent. of ash remains.

Halogen Salts.—Shake about 0.1 Gm. of Thymol Iodide for one minute with 20 mils of distilled water and filter. The filtrate does not become more than opalescent on the addition of a few drops of nitric acid and silver nitrate T.S.

Alkalies.—Shake about 0.5 Gm. of Thymol Iodide with 10 mils of distilled water and filter the mixture; the filtrate is not alkaline to litmus,

Free Iodine.—nor is it colored blue upon the addition of a few drops of starch T.S.

Assay.—Mix thoroughly about 0.25 Gm. of Thymol Iodide, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed, with about 3 Gm. of anhydrous sodium carbonate. Cover the mixture with about 1 Gm. more of anhydrous sodium carbonate and heat it moderately, in a crucible, gradually increasing the heat, but not exceeding a dull redness, until the mass is completely carbonized. When sufficiently cooled, extract the residue with boiling distilled water and wash it on a filter with boiling distilled water until the washings cease to produce an opalescence with silver nitrate T.S. Heat the combined washings, which measure about 150 mils, on a water bath and add an aqueous solution of potassium permanganate (1 in 20) in small portions, until the hot liquid remains permanently pink. Then add just enough alcohol to remove the pink tint, cool the liquid to room temperature, and dilute it to 200 mils. Mix it well and then filter through a dry filter, rejecting the first 50 mils of filtrate. To 100 mils of the subsequent clear filtrate add about 1 Gm. of potassium iodide (free from iodate) and an excess of diluted sulphuric acid, and titrate the liberated iodine with tenth-normal sodium thiosulphate V.S., adding starch T.S. near the end of the titration. It shows, in the dried Thymol Iodide, not less than 43 per cent. of I. Each mil of the tenth-normal sodium thiosulphate V.S. used corresponds to 0.002115 Gm. of I. Each gramme of Thymol Iodide corresponds to not less than 203.3 mils of tenth-normal sodium thiosulphate V.S.

Uses.—Thymol iodide or *aristol* is used in antiseptic surgery as a substitute for iodoform, and as an external application to ulcerations and various skin affections.

CATARIA. N. F. Catnep

[**Catar.**—CATMINT]

The dried leaves and flowering tops of *Nepeta Cataria* Linné (Fam. *Labiatæ*).

Official Description.—Tops, when whole, from 10 to 20 cm. in length, much branched, commonly crushed and broken; stems quadrangular, downy; leaves opposite, those of the stem petiolate from 2 to 7 cm. in length, rounded, heart-shaped at the base, oblong, pointed at the apex, pale gray-green, soft-hairy above, downy beneath, margin deeply crenate, floral leaves small, bract-like; flowers small, in dense, interrupted spikes; calyx hairy, tubular, curved obliquely and sub-equally five-toothed; corolla whitish, dotted with purple, throat dilated, limb bilabiate, the upper lip erect, two cleft, lower spreading, three cleft, the middle lobe largest, crenulate; stamens two pairs ascending under the upper lip, lower pair shorter.

Odor and Taste.—Odor faintly aromatic and mint-like; taste bitter pungent and aromatic.

Catnep yields not more than 16 per cent. of ash.

N. F. Preparation.—Fluidextractum Catariæ.

It contains a volatile oil and tannin.

Uses.—Used popularly as a carminative, stimulant, diaphoretic and emmenagogue. Dose, one drachm (4 Gm.).

SCUTELLARIA. N. F. Scutellaria

[Scutell.–SKULLCAP]

The dried plant of *Scutellaria lateriflora* Linné (Fam. *Labiatæ*).

Official Description.—About 50 cm. in length, smooth; stem quadrangular, branched; leaves opposite, petiolate, about 5 cm. in length, ovate-lanceolate or ovate-oblong, serrate; flowers about 6 mm. in length, in axillary one-sided racemes, with a pale blue corolla and bilabiate calyx, closed in fruit, the upper lip helmet-shaped.

Odor and Taste.—Odor slight; taste slightly bitter.

Scutellaria yields not more than 12 per cent. of ash.

N. F. Preparations.—Fluidextractum Scutellariæ; Tinctura Viburni Opuli Composita.

It contains volatile oil, tannin and a bitter principle.

Uses.—Used as a tonic and antispasmodic. Dose, fifteen grains (1 Gm.).

Unofficial Plants of the Labiatæ

Brunella	The herb of *B.* (*Prunella*) *vulgaris*. Found in North America, Asia, and Europe
Calamintha Wild Basil	The herb of *C. chinopodium*
Collinsonia Horsebalm	The herb of *Collinsonia canadensis*, grown in North America
Glechoma Ground Ivy	From *G. hederacea* and others, grown in Europe. It contains volatile oil resin, etc.
Hedeoma U. S. P. VIII American Pennyroyal	The dried leaves and flowering tops of *Hedeoma pulegioides* (Linné) Persoon (Fam. Labiatæ). It contains a volatile oil. It is stimulant and aromatic. Dose, two drachms (8 Gm.)
Hyssopus Hyssop	From *H. officinalis*, indigenous to Southern Europe. It contains about ½ per cent. of volatile oil, etc.
Lavender	The flowers of *Lavandula vera*. It was formerly official, and contains a volatile oil
Leonurus Motherwort	The herb of *L. cardiaca*, grown in Europe. It contains a volatile oil and a bitter principle
Lycopus Bugleweed	The herb of *L. virginicus*, found in the United States. It contains a volatile oil, resin, etc.
Melissa Balm U. S. P. 1890	The leaves and tops of *Melissa officinalis* Linné
Monarda Horsemint	The leaves and tops of *M. punctata*, indigenous to the United States. It contains a volatile oil, etc.
Rosemary	The leaves of *Rosmarinus officinalis*. It was formerly official, and contains a volatile oil
Salvia (Sage) U. S. P. VIII	The dried leaves of *Salvia officinalis* Linné (Fam. *Labiatæ*). It contains a terpene, $C_{10}H_{16}$, and an oxygenated portion, *salviol*, $C_{10}H_{18}O$. It is used as a condiment and an *infusion of sage* is used in sore throat. Dose, thirty grains (2 Gm.)

Official Products of the Aromatic Umbelliferæ

The aromatic plants belonging to the family Umbelliferæ are all characterized by the very distinctive properties of the volatile oils obtained by distilling their fruits (sometimes called seeds) with water. These oils are oxygenated, and are soluble in alcohol. Cumin and dill belong to this class. They are not official.

CARUM. U. S. Caraway

[CARAWAYSEED—CARAWAY SEED]

The dried fruit of *Carum Carvi* Linné (Fam. *Umbelliferæ*). Without the presence or admixture of more than 3 per cent. of other fruits, seeds or foreign matter. Preserve Caraway in tightly-closed containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects.

This fruit, commonly called caraway seed, contains about 5 per cent. of volatile oil, with a little fixed oil and other constituents.

Official Description.—Mericarps usually separated, crescent-shaped, 3 to 7 mm. in length, 1.5 mm. in diameter; externally dark brown with 5 yellowish filiform ribs; in transverse section nearly equilaterally pentagonal, the commissural surface with two vittæ, the dorsal surface with a vitta between each of the primary ribs; oily endosperm large, enclosing a small embryo.

Odor and Taste.—Agreeably aromatic.

Tests for Identity and Purity.—Under the microscope, transverse sections of Caraway show an epidermal layer of slightly tangentially elongated cells with thick outer walls; a layer of several rows of tangentially elongated parenchyma cells, frequently more or less collapsed; a single, large, elliptical, brown vitta or oil-tube between each of the ribs and surrounded by small epithelial or secretion cells; in each of the ribs a single fibro-vascular bundle surrounded by a layer of thick-walled sclerenchymatous fibers; inner epidermis of broadly elongated cells with very thin side walls, being very frequently broken and closely coherent with the more or less brownish collapsed cells of the seed-coat; commissural surface with 2 large vittæ and at the middle portion 2 large transverse hollow spaces formed by the separation of the tissues of the seed-coat on one side and the pericarp on the other, otherwise the cells resemble those on the dorsal surface; endosperm large, cells polygonal with thick walls and containing a fixed oil and aleurone grains, the latter not infrequently containing a small rosette aggregate or prism of calcium oxalate.

The powder is yellowish-brown, mostly of irregular, angular fragments; cells of endosperm with aleurone grains each usually containing a rosette aggregate of calcium oxalate about 0.001 mm. in diameter; fragments with light-yellow vittæ, together with nearly isodiametric or polygonal, yellowish-brown, inner epidermal cells of pericarp; fragments with tracheæ and sclerenchymatous fibers, the latter 0.01 mm. in width, slightly lignified and with numerous oblique pores.

Caraway yields not more than 8 per cent. of ash.

U. S. P. Preparation.—Tinctura Cardamomi Composita.

Uses.—It is used as a carminative and stimulant. Dose, fifteen grains (1 Gm.).

OLEUM CARI. U. S. Oil of Caraway

[Ol. Cari—CARAWAY OIL]

A volatile oil distilled from the fruit of *Carum Carvi* Linné (Fam. *Umbelliferæ*), and yielding not less than 50 per cent., by volume, of carvone [$C_{10}H_{14}O = 150.11$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

It consists of two liquid oils, of different boiling points, and separable by distillation: one a hydrocarbon called *carvene*, $C_{10}H_{16}$, of the specific gravity 0.849 and boiling point 176° C. (348.8° F.), now recognized as identical with d-limonene, the other the valuable constituent, d-carvone, $C_{10}H_{14}O$, of the sp. gr. 0.9638 and boiling point 224° C. (435.2° F.). This latter constituent is often extracted from the oil and prepared in a pure state by taking advantage of the formation of a crystalline compound of carvone and hydrogen sulphide, which can then be decomposed by treatment with alcoholic potassium hydroxide.

Sulphides are found in the aqueous distillate which comes over with the oil, as are also several constituents which are ordinarily considered only to accompany destruction distillation products, as methyl alcohol, acetaldehyde, etc.

Official Description.—A colorless or pale yellow liquid.

Odor and Taste.—Characteristic odor and taste of caraway.

Solubility.—Soluble in 8 volumes of 80 per cent. alcohol.

Specific Gravity.—0.900 to 0.910 at 25° C. (77° F.).

Tests for Identity.—Its optical rotation varies between +70° and +80° in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

Assay.—Introduce 10 mils of the Oil into a 200-mil flask with a long graduated neck (cassia flask) by means of a pipette, add 50 mils of a saturated solution of sodium sulphite, which has been carefully rendered neutral to phenolphthalein T.S. by means of acetic acid, heat the mixture in a bath containing boiling water and shake the flask repeatedly, neutralizing the mixture from time to time by the addition of a few drops of diluted acetic acid. When no coloration appears, upon the addition of a few more drops of phenolphthalein T.S. and heating for fifteen minutes, cool, and, when the liquids have separated completely, add sufficient of the sodium sulphite solution to raise the lower limit of the oily layer within the graduated portion of the neck and note the volume of the residual liquid. This measures not more than 5 mils, indicating the presence of not less than 50 per cent., by volume, of carvone.

U. S. P. Preparation.—Spiritus Juniperi Compositus.

N. F. Preparations.—Elixir Cardamomi Compositum (from Compound Spirit); Mistura Carminativa; Pilulæ Aloes, Hydrargyri et Scammoniæ Compositæ; Spiritus Cardamomi Compositus.

Uses.—It is a valuable aromatic oil, used in making caraway water and officially in compound spirit of juniper. Dose, three minims (0.2 mils).

FŒNICULUM. U. S. Fennel

[Fœnic.—FENNEL SEED]

The dried, ripe fruit of cultivated varieties of *Fœniculum vulgare* Miller (Fam. *Umbelliferæ*), without the presence or admixture of more than 4 per cent. of foreign matter.

Official Description.—Mericarps usually separate, each being broadly elliptical, more or less curved, from 4 to 10 mm. in length and from 1 to 3.5 mm. in breadth, some having a slender stalk from 2 to 10 mm. in length; dorsal surface convex, yellowish-green to grayisn-brown, with three prominent, longitudinal primary ribs and at the summit a short, conical stylopodium; commissural surface with three narrow, light brown, longitudinal areas separated by two dark brown or brownish-black areas containing the vittæ or oil-tubes.

Odor and Taste.—Aromatic and characteristic.

Tests for Identity and Purity.—Under the microscope, transverse sections of Fennel show a pentagonal mericarp, four of the edges being nearly equal and slightly concave, the other or commissural surface being much longer and more or less undulate; cells of the seed-coat closely united with those of the pericarp, giving the section two very distinct areas, the inner and larger portion (endosperm) more or less rounded-pentagonal and somewhat reniform, composed of polygonal cells, filled with aleurone grains containing rosette aggregates of calcium oxalate and a thin protoplasmic layer enclosing a fixed oil; the outer or pericarp layer distinguished by large elliptical vittæ with thick, brown walls, occurring singly and alternating with the primary ribs, and two vittæ on the dorsal surface, making usually six vittæ in all, there sometimes being, however, one or two vittæ additional; in the central portion of each of the ribs occurs a nearly circular, fibro-vascular bundle with a few tracheæ and numerous thin-walled, strongly lignified sclerenchymatous fibers.

The powder is yellowish-brown, consisting of irregular angular fragments; tissues of endosperm, colorless, the cells filled with aleurone grains, each containing a rosette aggregate of calcium oxalate, about 0.002 mm. in diameter; fragments containing yellowish-brown vittæ, from 0.1 to 0.2 mm. in width; sclerenchymatous fibers few, strongly lignified and with numerous, oblique, simple pores; parenchyma cells with more or less thick walls and simple pores and occasionally reticulately thickened; tracheæ few and either spiral or annular; in mounts made with hydrated chloral T.S., numerous globules of a fixed oil separate.

Fennel yields not more than 9 per cent. of ash.

U. S. P. Preparation.—Infusum Sennæ Compositum.

N. F. Preparations.—Pilulæ Antiperiodicæ; Pilulæ Antiperiodicæ sine Aloe; Species Laxativæ; Tinctura Antiperiodica; Tinctura Antiperiodica sine Aloe.

This fruit contains about 5 per cent. of an oxygenated volatile oil, with 10 per cent. of fixed oil. It is used as a flavor and to modify the action of purgatives. Dose, fifteen grains (1 Gm.).

OLEUM FŒNICULI. U. S. Oil of Fennel

[Ol. Fœnic.—FENNEL OIL]

A volatile oil distilled from ripe fruit collected from cultivated varieties of *Fœniculum vulgare* Miller (Fam. *Umbelliferæ*). If wholly or partly solidified, carefully warm the Oil until liquefied and thoroughly mix it before dispensing. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

The property of this oil of solidifying at a low temperature is used in the official test to indicate its purity. Oil of fennel consists of *anethol*, $C_{10}H_{12}O$ (a phenol-ether forming a white solid melting at 21° C. (69.8° F.)) (see *Oleum Anisi*), the latter usually in amounts of about 60 per cent., d-pinene, phellandrene, dipentene, *fenchone*, $C_{10}H_{16}O$ (a liquid ketone), chavicol, anisic aldehyde, and anisic acid. Fenchone is the constituent which when present gives the disagreeable bitter taste to many of the commercial oils. Limonene is also at times present as a constituent. There is reason to believe that much of the commercial oil is adulterated with oil from which the anethol or crystalline constituent has been separated; the official solidifying point, not below 3° C. (37.4° F.), should be required.

Official Description.—A colorless or pale yellow liquid.

Odor and Taste.—Characteristic odor and taste of fennel.

Solubility.—Soluble in 8 volumes of 80 per cent. alcohol and in 1 volume of 90 per cent. alcohol, forming a solution neutral to litmus.

Specific Gravity.—0.953 to 0.973 at 25° C. (77° F.).

Tests for Identity and Purity.—The optical rotation varies from +12° to +24° in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

When tested by the method under *Oleum Anisi*, with the following modifications, the congealing point of the Oil does not fall below 3° C. (37.4° F.). Cool the test tube containing the 10 mils of Oil of Fennel in a freezing mixture until the temperature has fallen to 0° C. (32° F.), and induce crystallization as directed.

U. S. P. Preparations.—Aqua Fœniculi; Pulvis Glycyrrhizæ Compositus; Spiritus Juniperi Compositus.

N. F. Preparations.—Elixir Anisi; Elixir Glycyrrhizæ Aromaticum; Fluidglyceratum Cascaræ Sagradæ Aromaticum; Mistura Carminativa; Pilulæ ad Prandium (Chapman's); Syrupus Ficorum Compositus; Syrupus Rhamni Catharticus.

Uses.—It is used as a stimulant and flavor and to overcome flatulence and modify the action of purgatives. The dose is three minims (0.2 mil).

CORIANDRUM. U. S. Coriander

[Coriand.—CORIANDER SEED]

The dried ripe fruit of *Coriandrum sativum* Linné (Fam. *Umbelliferæ*), without the presence or admixture of more than 5 per cent. of other fruits, seeds, or foreign matter.

Official Description.—Mericarps usually coherent; cremocarp nearly globular, from 3 to 5 mm. in diameter; externally light brown or rose colored; summit with 5 calyx teeth and a short stylopodium, each mericarp with 5 prominent, straight, longitudinal, primary ribs and 4 indistinct, undulate secondary ribs; mericarps easily separated, deeply concave on the inner or commissural surface and showing in transverse section 2 vittæ (oil tubes) on the inner surface of each.

Tests for Identity and Purity.—Under the microscope, sections of Coriander show an epidermis of small cells with thick walls; a layer of several rows of thin-walled more or less collapsed parenchyma separated from a broad zone of strongly lignified, sclerenchymatous fibers which extend as a continuous ring in the mesocarp of each of the mericarps; 2 or 3 layers of large, tangentially elongated, thin-walled parenchyma cells, frequently with numerous large lysigenous intercellular spaces; inner epidermis of large tabular cells, the inner yellowish walls being considerably thickened and closely coherent to the brownish cells of the seed-coat; commissural surface with 2 large, elliptical vittæ; the cells of the pericarp separated from the seed-coat and forming a large elliptical cavity; endosperm distinctly reniform in outline and consisting of tabular or polygonal thick-walled cells containing numerous large aleurone grains, each with a rosette aggregate or prism of calcium oxalate.

The powder is light brown, consisting chiefly of fragments of endosperm and lignified tissues of the pericarp; calcium oxalate crystals numerous, from 0.003 to 0.01 mm. in diameter, mostly in rosette aggregates, either isolated or in aleurone grains; sclerenchymatous fibers irregularly curved, having thick, yellowish, lignified walls and numerous simple pores; numerous globules of fixed oil; fragments of light yellow vittæ few, associated with elongated polygonal epidermal cells.

Coriander yields not less than 0.5 per cent. of volatile extractive, soluble in ether (see U. S. P., Test No. 12, Chapter LXII).

Coriander yields not more than 7 per cent. of ash.

N. F. Preparations.—Fluidextractum Stillingiæ Compositum; Infusum Gentianæ Compositum.

Uses.—This fruit furnishes an agreeable aromatic oil. The yield is about 1 per cent. It also contains about 10 per cent. of fixed oil. The fruit is seldom used alone, but is often combined with other remedies, chiefly as a flavor. It is also used as a condiment and flavor in cooking. Dose, eight grains (0.5 Gm.).

OLEUM CORIANDRI. U. S. Oil of Coriander

[**Ol. Coriand.**—CORIANDER OIL]

A volatile oil distilled from the ripe fruit of *Coriandrum sativum* Linné (Fam. *Umbelliferæ*). Preserve it in well-stoppered, amber-colored bottles, in a cool place protected from light.

This is an oxygenated oil, consisting chiefly of a compound, *coriandrol*, $C_{10}H_{18}O$, which boils between 194° and 198° C. (381.2° and 388.4° F.), it is optically dextrogyrate, and has a sp. gr. of 0.8679 at 20° C. (68° F.). Coriandrol is now known as dextrogyrate *linalool.* Coriander oil also contains about 5 per cent. of dextropinene. The characteristic odorous principle or principles are unknown.

Official Description.—A colorless or pale yellow liquid.
Odor and Taste.—Characteristic odor and taste of coriander.
Solubility.—Soluble in 3 volumes of 70 per cent. alcohol.
Specific Gravity.—0.863 to 0.875 at 25° C. (77° F.).
Tests for Identity and Purity.—The optical rotation varies from +8° to +13° in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

U. S. P. Preparations.—Elixir Aromaticum (from Spirit); Fluidextractum Cascaræ Sagradæ Aromaticum; Spiritus Aurantii Compositus; Syrupus Sennæ.
N. F. Preparation.—Confectio Sennæ.

Uses.—It is used as a stimulant and corrective in a dose of three minims (0.2 mil).

SUMBUL. U. S. Sumbul

[MUSK-ROOT]

The rhizome and roots of *Ferula Sumbul* (Kauffmann) Hooker filius (Fam. *Umbelliferæ*).

This Asiatic root contains about ½ per cent. of volatile oil and about 10 per cent. of a resinous compound having a musky odor.

Official Description.—In transverse segments, attaining a length of 10 cm. and a diameter of 7 cm.; externally light brown to dark brown, longitudinally wrinkled and showing in the upper portions a smooth, grayish, epidermal layer, occasionally with the short stem-bases attached; fracture short, fibrous, spongy; internally light yellow or brownish-yellow, arrangement of wood irregular and with yellowish-brown or blackish resinous patches frequently extending over the entire ends of the segments.

Odor and Taste.—Odor peculiar, musk-like; taste bitter and somewhat aromatic.

Tests for Identity.—The powder is grayish-brown; when examined under the microscope it exhibits numerous, irregular, brownish-black fragments and well-defined isolated tracheæ, the latter with distinct end-walls, and mostly with reticulate thickenings and from 0.03 to 0.1 mm. in width; occasional fragments of polygonal epidermal cells with yellowish-brown walls; numerous, nearly colorless, yellowish brown and reddish-brown fragments consisting of a granular substance in which the cellular structure is not well defined; long, narrow fragments consisting of more or less collapsed leptome or sieve tissue; occasional fragments of well-defined parenchyma with a few nearly spherical starch grains, from 0.003 to 0.012 mm. in diameter.

U. S. P. Preparations.—Extractum Sumbul; Fluidextractum Sumbul; Tinctura Sumbul.

Uses.—It is used as a stimulant and nervine. Dose, 30 grains (2 Gm.).

ANISUM. U. S. Anise

[**Anis.**—Aniseed]

The dried ripe fruit of *Pimpinella Anisum* Linné (Fam. *Umbelliferæ*) without the presence or admixture of more than 3 per cent. of foreign seeds or other vegetable matter.

Official Description.—Cremocarp broadly ovoid or pyriform, laterally compressed, from 3 to 6 mm. in length and from 2 to 3 mm. in breadth; mericarps usually cohering and attached to a slender pedicel from 2 to 12 mm. in length; summit with a ring-like disk and 2 projecting, diverging styles; externally grayish or greenish-gray, seldom grayish-brown, slightly pubescent; each with five light brown filiform ridges and in cross-section with from 15 to 45 vittæ.

Odor and Taste.—Odor and taste agreeable and aromatic.

Tests for Identity.—Under the microscope transverse sections of Anise show an epidermal layer with numerous papillæ and short, one-celled, non-glandular hairs having very thick papillose walls; primary ribs each with a small fibro-vascular bundle, surrounded by a few sclerenchymatous fibers; vittæ or oil-tubes from 15 to 45 in number, extending as a more or less interrupted circle in the tissues of the mesocarp on the dorsal side of each mericarp; 2 large vittæ on the commissural surface, each separated from the other tissues of the mericarp by a large cavity due to shrinkage of the seed-coat; inner epidermis of pericarp consisting of a layer of narrow, tangentially elongated cells closely united with the 1-layered seed-coat, the inner walls of which are yellowish-brown and considerably thickened; endosperm of polygonal, thick-walled cells filled with spherical or ellipsoidal aleurone grains, each containing a small rosette aggregate of calcium oxalate; the aleurone grains surrounded with an oily protoplasm, the oil of which is liberated upon mounting sections in hydrated chloral T.S., in the form of small globules; epidermal layer near the middle of the commissural surface composed of 2 or 3 rows of cells with thick, porous walls, and beneath which occur small groups of thick-walled cells resembling stone cells.

The powder is yellowish brown, consisting of numerous irregular fragments of pericarp showing portions of the yellowish vittæ, fragments with tracheæ and sclerenchymatous fibers of carpophore; cells of endosperm filled with aleurone grains about 0.006 mm. in diameter, each usually enclosing a rosette aggregate crystal of calcium oxalate about 0.002 mm. in diameter; non-glandular hairs 1-celled, from 0.025 to 0.2 mm. in length, either straight or curved and with numerous, slight, centrifugal projections on the outer surface.

Heat 1 Gm. of the whole drug or powdered drug with 10 mils of potassium hydroxide T.S.; no mouse-like odor develops (fruits of *Conium maculatum* Linné).

Anise yields not more than 9 per cent. of ash.

N. F. Preparations.—Species Laxativæ; Species Pectorales; Tinctura Rhei Dulcis.

Uses.—This fruit contains about 2 per cent. of volatile oil and 3 per cent. of fixed oil. It is a useful carminative and stimulant. Dose, eight grains (0.5 Gm.).

OLEUM ANISI. U. S. Oil of Anise. Oil of Star Anise

[Ol. Anisi —Anise Oil]

A volatile oil distilled from the ripe fruit of *Pimpinella Anisum* Linné (Fam. *Umbelliferæ*) or from the ripe fruit of *Illicium verum* Hooker filius (Fam. *Magnoliaceæ*). The botanical source from which it is derived must be stated on the label. If solid material has separated, carefully warm the Oil until liquefied, and thoroughly mix it before dispensing. Preserve it in well-stoppered, amber-colored bottles, protected from light.

Oil of Illicium (*Star Anise*) has the same properties as the oil from *Pimpinella Anisum.* It consists of a small quantity of terpene, $C_{10}H_{16}$, but mainly of *anethol,* parapropenylanisol, $C_6H_4C_3H_5OCH_3$ (about 85 per cent.), which is present, however, in two isomeric modifications, one solid at ordinary temperatures and heavier than water (*solid anethol*), the other liquid and more volatile (*estragol* or *methyl chavicol*). *Anethol,* both in the liquid and in the solid form, is present, and is the chief constituent of the oils of *anise, star anise,* and *fennel.* The solidification test of the U. S. P. is based upon the anethol content. By oxidation, by means of nitric acid, or chromic anhydride, the different forms of anethol yield *anisic acid,* $C_8H_8O_3$. Oil of anise, by exposure to air, is oxidized with the formation of *anisic aldehyde, acetic aldehyde* and *anisic acid,* and becomes less disposed to congeal.

Official Description.—A colorless or pale yellow, strongly refractive liquid.

Odor and Taste.—Characteristic odor and taste of anise.

Solubility.—Soluble with not more than a slight cloudiness in 3 volumes of 90 per cent. alcohol.

Specific Gravity.—0.978 to 0.988 at 25° C. (77° F.).

Tests for Identity and Purity.—Refractive index: 1.544 to 1.560 at 20° C. (68° F.) (see U. S. P., Test No. 22, Chapter LXII).

Oil of Fennel.—The optical rotation varies from +1° to −2° in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

Phenols.—An alcoholic solution prepared as above is neutral to litmus and develops no blue or brownish color upon the addition of a drop of ferric chloride T.S.

Heavy Metals.—It does not respond to the Test for heavy metal in volatile oils (see U. S. P., Test No. 3, Chapter LXII).

When tested by the following method, the congealing point of the Oil does not fall below 15° C. (59° F.). Transfer about 10 mils of the Oil to a test tube, place it in a water bath cooled with ice, insert a thermometer at once into the Oil and allow it to remain undisturbed until the temperature has fallen to about 12° C. (53.6° F.). Then induce crystallization either by rubbing the inner wall of the test tube with the thermometer or by the addition of a particle of solid anethol, remove the test tube from the bath and stir during the solidification of the Oil. The highest temperature reached during the crystallization is regarded as the congealing point.

U. S. P. Preparations.—Aqua Anisi; Elixir Aromaticum (from Spirit); Fluidextractum Cascaræ Sagradæ Aromaticum; Spiritus Anisi; Spiritus Aurantii Compositus; Syrupus Sarsaparillæ Compositus; Tinctura Opii Camphorata.

N. F. Preparations.—Elixir Phosphori; Tinctura Pectoralis.

Uses.—Oil of anise is given as a carminative in the dose of three minims (0.2 mil).

ANETHOL. N. F. Anethol

The methyl ether of para-propenyl phenol [$C_6H_4.C_3H_5.OCH_3 = 148.1$]. It is the main constituent in the oils of anise, star anise, and fennel, and is usually obtained from these by fractioning, chilling and crystallizing. Preserve it in well-stoppered, amber-colored bottles protected from light and air.

Official Description.—A colorless or faintly yellow, highly refractive liquid at a temperature of 23° C. (73.4° F.) or above, having a sweet taste and the aromatic odor of anise. At from 20° to 21° C. (68°–69.8° F.) it solidifies to a white, glistening, crystalline mass which remelts at from 22° to 23° C. (71.6°–73.4° F.).

Solubility.—Almost insoluble in water; readily soluble in ether or chloroform, and forms a clear solution with two volumes of alcohol.

Specific Gravity.—0.984 to 0.986 at 25° C. (77° F.).

Tests for Identity and Purity.—Boiling point: 232° to 234° C. (449.6°–453.2° F.).

Refractive index: 1.5 at 20° C. (68° F.).

It is optically inactive or shows a deviation of not more than 0.08° in a 100-mm. tube at 25° C. (77° F.), due to slight traces of the oil from which the Anethol has been prepared (if prepared from oil of anise, this deviation will be lævorotatory, if from oil of fennel, dextrorotatory).

Aldehydes.—Shake 10 mils of Anethol with 50 mils of a saturated aqueous solution of sodium bisulphite in a graduated cylinder and allow the mixture to stand for six hours. No appreciable diminution in the volume of Anethol will be observed nor does a crystalline deposit separate.

N. F. Preparations.—Elixir Anisi; Elixir Cardamomi Compositum (from Compound Spirit of Cardamom); Pulvis Rhei et Magnesiæ Anisatus; Spiritus Ammoniæ Anisatus; Spiritus Cardamomi Compositus.

Uses.—Its uses are similar to those described under Oil of Anise. It is frequently sold as *Synthetic* or *Artificial Oil of Anise.*

ANGELICÆ FRUCTUS. N. F. Angelica Fruit

[**Angel. Fruct.**—ANGELICA SEED]

The ripe fruit of *Angelica Archangelica* Linné (Fam. *Umbelliferæ* and of other species of *Angelica,* without the presence of more than 3 per cent. of foreign matter.

Official Description.—Cremocarps oval, externally of a pale yellowish-brown color, from 4 to 8 mm. in length, 3 to 6 mm. in breadth and from 1 to 2 mm. in thickness, the base faintly notched, the summit bearing five minute calyx-teeth and the remains of the style; the two mericarps joined by their broad faces, or separate; each mericarp nearly flat upon one surface, which bears a central longitudinal groove and has sharp, slightly upturned margins, convex upon the other surface, which is traversed longitudinally upon the back by three strong ribs, separated from one another by narrow grooves and from the margin by much broader grooves; pericarp soft, rather tough and corky and enclosing a single seed, showing on cross section six large oil-tubes.

Odor, Taste, and Purity.—Odor characteristic and agreeable; taste aromatic, pungent, and sweetish.

Angelica Fruit yields not more than 8 per cent. of ash.

N. F. Preparations.—Pilulæ Antiperiodicæ; Pilulae Antiperiodicæ sine Aloe; Tinctura Antiperiodicæ; Tinctura Antiperiodicæ sine Aloe.

Uses.—It is used as a stimulating expectorant in doses of fifteen grains (1 Gm.).

ANGELICÆ RADIX. N. F. Angelica Root

[**Angel. Rad.**]

The rhizome and roots of *Angelica atropurpurea* Linné (Fam. *Umbelliferæ*) and of other species of *Angelica,* without the presence of more than 5 per cent. of stem bases and leaves or other foreign matter. Preserve Angelica Root in air-tight containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects.

Official Description.—Rhizomes short and thick, from 5 to 10 cm. in length, sometimes split, frequently crowned with the bases of stem and leaves; the roots are numerous, from 10 to 20 cm. in length and from 5 to 7 mm. in thickness at the base and gradually tapering to about 1 mm.; frequently twisted or braided together, externally dark gray-brown to reddish- or purplish-brown and with conspicuous, rather deep furrows; when dry breaking with a smooth fracture.

On cross section, the rhizome shows a distinct pith, which is absent in the root, and both exhibit a spongy bark nearly or quite as wide as the woody zone; in the bark are radial rows of brownish canals containing oleoresin. The wood rays are finely porous and narrower than the medullary rays. The bark is rich in starch.

Odor and Taste.—Odor strongly aromatic; taste sweetish, pungent, aromatic, and then bitter.

Tests for Identity and Purity.—The powdered drug is yellowish-brown and, when examined under the microscope, exhibits numerous, mostly simple, irregularly spherical starch grains, up to 0.008 mm. in diameter, sometimes with the cleft at the center and occasionally two or more compound; tracheæ or fragments of tracheæ, with reticulate markings or large simple pores up to 0.075 mm. in width; brownish oil canals or fragments thereof, up to 0.25 mm. in diameter, sometimes with adjoining epithelial cells; fragments of parenchyma tissue with some of the cells filled with starch; fragments of large brownish cork cells; sclerenchymatous fibers with thin walls and often with oblique markings; yellowish oil globules.

Angelica Root yields not more than 8 per cent. of ash.

N. F. Preparation.—Fluidextractum Angelicæ Radicis.

Uses.—It is used as an expectorant and emmenagogue in doses of thirty grains (2 Gm.).

PETROSELINUM. U. S. Parsley Fruit

[**Petrosel.**—Parsley Seed]

The dried ripe fruit of *Petroselinum sativum* Hoffman (Fam. *Umbelliferæ*), without the presence or admixture of more than 5 per cent. of foreign seeds and other matter. Preserve Parsley Fruit carefully in tightly closed containers, protected from light.

This drug contains about 1.5 per cent. of a volatile oil of a specific gravity 1.01 to 1.14, also an oleoresin from which a crystalline substance, known as *apiol,* may be extracted by shaking with ether and subsequent purification. Apiol crystallizes in long needles which melt at 30° C. (86° F.). They are insoluble in water but readily soluble in alcohol and ether.

Official Description.—Mericarps usually separated, ovoid-crescent shaped, from 2 to 3 mm. in length and about 1 mm. in diameter; externally grayish-brown, becoming grayish or brownish on aging, having 5 yellowish, filiform, prominent ribs, alternating with the coarsely roughened furrows; in transverse section nearly hemispherical, the commissural surface with 2 vittæ or oil-tubes, the dorsal surface usually with a single vitta, occasionally 2 vittæ in the grooves between the primary ribs; endosperm large, oily, enclosing a small embryo.

Odor and Taste.—Odor and taste characteristic and aromatic, especially when bruised.

Tests for Identity and Purity.—Under the microscope, sections of Parsley Fruit show an epidermal layer with thick cuticularized walls having numerous small centrifugal projections; several layers of small, thin-walled parenchyma cells, being usually considerably collapsed and occasionally containing a rosette aggregate of calcium oxalate; a single, large, brown elliptical vitta or oil-tube between each of the primary ribs and surrounded by a layer of comparatively large, yellowish-brown tangentially elongated cells; a single fibro-vascular bundle more or less surrounded by a few or occasionally numerous sclerenchymatous fibers; inner epidermis of narrow, thin-walled elongated cells closely cohering with the brownish tabular cells of the seed coat; commissural surface usually with 2 large vittæ, a very few stone cells and showing a slight separation of pericarp and seed-coat; endosperm of polygonal, thick-walled parenchyma cells containing fixed oil and numerous, small aleurone grains usually containing a small rosette aggregate of calcium oxalate. The vittæ usually contain yellowish oil globules or a resin-like mass adhering to the walls, and occasionally are divided by a radial wall.

The powder is grayish-brown; mostly of large, irregular fragments; cells of endosperm with aleurone grains each usually containing a rosette aggregate of calcium oxalate from 0.003 to 0.007 mm. in diameter; fragments with light yellow vittæ and the yellowish-brown cells of the pericarp; fragments with narrow tracheæ and more or less lignified sclerenchymatous fibers.

U. S. P. Preparation.—Oleoresina Petroselini.

Uses.—The oleoresin, commonly known as *liquid apiol,* is used as an emmenagogue and antiperiodic (see page 600).

PETROSELINI RADIX. N. F. Parsley Root

[Petrosel. Rad.]

The dried root of *Petroselinum sativum* Hoffman (Fam. *Umbelliferæ*).

Official Description.—The entire fusiform root, measuring up to 20 cm. in length and up to 2.5 cm. in thickness at the crown, or broken or cut into pieces; usually cut lengthwise into two or four sections; externally light yellowish, wrinkled longitudinally, somewhat annulate, root scars distinct and corky; fracture tough when damp, brittle when dry; internally, cortex whitish and characterized by numerous, reddish-brown oleoresin cells, cambium zone distinct and brownish; wood about the same thickness as the cortex, slightly radiate and light yellow.

Odor and Taste.—Odor aromatic; taste sweetish and pungent.

Tests for Identity and Purity.—The powdered drug, when examined under the microscope, shows numerous truncate or somewhat angular starch grains up to 0.03 mm. in diameter, reticulate tracheæ up to 0.06 mm. in width and thin-walled, lignified fibers with simple pores.

Parsley Root yields not more than 6 per cent. of ash

N. F. Preparation.—Fluidextractum Petroselini Radicis.

Uses.—As an antiperiodic and emmenagogue in doses of thirty grains (2 Gm.).

APII FRUCTUS. N. F. Celery Fruit

[Apii Fruct. CELERY SEED]

The ripe fruit of *Apium graveolens* Linné (Fam. *Umbelliferæ*), without the presence of more than 10 per cent. of foreign fruit or other foreign matter.

It contains a volatile oil and small quantities of *apiol.*

Official Description.—The fruits consist of two mericarps which may be united or separate. Mericarps ovoid, slightly curved, from 1 to 2 mm. in length, rather more than half as broad and about half as thick, of a rather deep brown color; the inner surface flat, the outer convex, smooth except for five very slender light-colored ribs, two of which are marginal. Oil-tubes in the pericarp from 6 to 15.

Odor and Taste.—Odor characteristic, agreeable; taste aromatic, warm and somewhat pungent.

Tests for Identity and Purity.—Transverse sections, when examined under the microscope, exhibit nearly equilateral pentagonal mericarps, with somewhat convex surfaces; the carpophore consisting of two groups of strongly lignified sclerenchyma cells; each mericarp has from six to fifteen vittæ in the pericarp, the latter closely surrounding a somewhat pentagonal seed; the pericarp has an epidermal layer of cells elongated tangentially and with a thick cuticle; a few of the cells are developed into short, smooth papillæ; a fibro-vascular bundle in each of the prominent ribs, composed of a few tracheæ and strongly lignified sclerenchyma fibers; the inner tissue of the pericarp consists of largely tangentially elongated parenchyma with brownish walls; the seed consists chiefly of endosperm; the seed-coat is composed of several layers of yellowish more or less collapsed cells, the endosperm of thick-walled polygonal cells containing fixed oil and aleurone grains, the latter each containing a small rosette aggregate of calcium oxalate.

The powdered drug is oily and has a brown color and, when examined under the microscope, exhibits fragments of the pericarp showing yellowish vittæ, brown secretion cells and a few of the epidermal papillæ; tracheæ and sclerenchyma fibers; cells of the endosperm with aleurone grains containing rosette aggregates of calcium oxalate from 0.002 to 0.006 mm. in diameter.

Celery Fruit yields not more than 8 per cent. of ash.

N. F. Preparation.—Fluidextractum Apii Fructus.

Uses.—Used as a condiment and medicinally as an antispasmodic and nerve stimulant. The dose is thirty grains (2 Gm.).

Unofficial Volatile Oils and Plants of the Umbelliferæ

Anethum Graveolens Dill	An umbelliferous fruit, indigenous to Southern Europe
Oleum Anethi Oil of Dill	An oxygenated oil. The yield is about 4 per cent.
Carota Carrot Fruit	The fruit of *Daucus Carota*, indigenous to Northern Asia
Oil of Carrot	An oxygenated oil
Cicuta Water Hemlock	The herb of *Cicuta virosa*, found in Northern Canada
Cuminum Cumin	The fruit of *Cuminum Cyminum*, indigenous to Egypt
Oil of Cumin	Consists of several hydrocarbons. The yield is about ¼ per cent.
Heracleum Cow Parsnip (Masterwort)	From *Heracleum lanatum*, grown in the United States. It contains a volatile oil, resin, etc.
Levisticum Lovage	The root of *Levisticum officinale*, indigenous to Southern Europe. It contains soft and pungent resins
Phellandrium Water Fennel	The fruit of *Œnanthe Phellandrium*, grown in Europe. It contains about 1½ per cent. of volatile oil and resins

Official Products from the Lauraceæ

CINNAMOMUM SAIGONICUM. U. S. Saigon Cinnamon [Cinnam. Saigon.]

The dried bark of an undetermined species of *Cinnamomum* (Fam. *Lauraceæ*).

Official Description.—In quills attaining a length of 30 cm., and from 3 to 30 mm. in diameter; the bark from 0.5 to 3 mm. in thickness; outer surface light brown to dark purplish-brown with grayish patches of foliaceous lichens and numerous bud-scars; finely wrinkled, especially the bark of younger twigs, otherwise more or less rough from corky patches surrounding the lenticels; inner surface reddish-brown to dark brown, granular, and slightly striate; fracture short; inner bark porous, owing to the presence of large oil cells and mucilage cells, and separated by a continuous layer of stone cells from the outer bark.

Odor and Taste.—Odor aromatic; taste sweetish, aromatic and pungent.

Tests for Identity and Purity.—Under the microscope, sections of the older bark of Saigon Cinnamon show a thin layer of more or less lignified cork cells; a narrow layer of starch-bearing parenchyma with scattered stone cells; a nearly continuous zone, several layers wide, of stone cells, among which are small groups of bast-fibers with thickened and slightly lignified walls; a wide inner bark with medullary rays 1 to 3 cells in width, isolated bast-fibers, mucilage cells, oil cells and parenchyma, the cells of the latter either filled with starch grains or containing very small raphides of calcium oxalate; the lumina of parenchyma cells, stone cells and bast-fibers frequently filled with an amorphous reddish-brown substance, which is for the most part insoluble in the ordinary reagents. In the bark of young twigs there is an epidermal layer with a thick yellowish cuticle, fewer stone cells in the zone associated with bast-fibers, and the inner bark is narrower and with fewer secretion cells than in the older bark.

The powder is yellowish- or reddish-brown; starch grains numerous, single or compound, the individual grains being somewhat ellipsoidal or polygonal and from 0.003 to 0.02 mm. in diameter; fragments, with colorless stone cells rather prominent, the cells being very irregular in shape and the lumina containing either air or a reddish-brown amorphous substance; bast-fibers from 0.3 to 1.5 mm. in length and usually in groups of from 2 to 20 with very thick and scarcely lignified walls; numerous cellular, reddish-brown fragments in which the oil cells are not readily distinguishable.

Saigon Cinnamon yields not less than 2 per cent. of volatile extractive, soluble in ether (see U. S. P., Test No. 12, Chapter LXII).

Saigon Cinnamon yields not more than 6 per cent. of ash. The amount of ash insoluble in diluted hydrochloric acid does not exceed 2 per cent. of the weight of Saigon Cinnamon taken.

U. S. P. Preparations.—Fluidextractum Aromaticum (from Aromatic Powder); Pulvis Aromaticus; Tinctura Cardamomi Composita; Tinctura Cinnamomi; Tinctura Gambir Composita; Tinctura Lavandulæ Composita; Tinctura Rhei Aromatica.

N. F. Preparations.—Cordiale Rubi Fructus; Elixir Rubi Compositum; Elixir Taraxaci Composita (from Tincture); Mistura Rhei Alkalina (from Tincture); Pulvis Aromaticus Rubifaciens; Pulvis Cretæ Aromaticus; Pulvis Gambir Compositus; Pulvis Kino et Opii Compositus; Syrupus Cinnamomi; Syrupus Sennæ Aromaticus; Tinctura Antiperiodicæ; Tinctura Antiperiodicæ sine Aloe; Tinctura Aromatica; Tinctura Opii Crocata; Tinctura Pectoralis (from Compound Tincture of Gambir); Tinctura Viburni Opuli Composita; Tinctura Aurantii Composita.

CINNAMOMUM ZEYLANICUM. U. S. **Ceylon Cinnamon**

[Cinnam. Zeylan.]

The dried bark of cultivated trees of *Cinnamomum zeylanicum* Breyne (Fam. *Lauraceæ*), without the presence or admixture of more than 3 per cent. of the outer bark or other foreign matter.

Official Description.—In closely rolled double quills, composed of from 7 to 12 thin layers of separate pieces of bark, from 30 to 50 cm. in length and from 8 to 13 mm. in diameter; the bark attaining a thickness of 1 mm.; outer surface pale yellowish-brown, smooth, longitudinally striate with narrow yellowish groups of bast-fibers, and showing circular or irregular brownish patches, occasionally with perforations marking the nodes, inner surface light brown, with faint, longitudinal striations; fracture short with projecting bast-fibers.

Odor and Taste.—Odor agreeably aromatic; taste sweetish and warmly aromatic.

Tests for Identity and Purity.—Under the microscope sections of Ceylon Cinnamon usually show no cork but an almost continuous outer layer of stone cells, among which are small groups of bast-fibers resembling those found in *Saigon Cinnamon;* in the inner bark occur numerous bast-fibers singly or in small groups, medullary rays 1 to 2 cells in width, usually with raphides of calcium oxalate; parenchyma with either reddish-brown contents or more or less filled with starch grains; scattered throughout the parenchyma occur oil secretion cells and mucilage cells.

The powder is light brown or yellowish-brown; starch grains numerous, varying from spherical to polygonal, from 0.003 to 0.02 mm. in diameter, frequently in small aggregates; bast-fibers from 0.3 to 0.8 mm. in length, usually single, spindle-shaped, with attenuated ends, the walls being very thick and but slightly lignified; colorless stone cells resembling those of *Saigon Cinnamon;* numerous cellular fragments with yellowish-brown walls or contents; cork cells few or none; calcium oxalate in raphides, from 0.005 to 0.008 mm. in length.

Ceylon Cinnamon yields not less than 0.5 per cent. of volatile extractive, soluble in ether (see U. S. P., Test No. 12, Chapter LXII).

Ceylon Cinnamon yields not more than 6 per cent. of ash. The amount of ash insoluble in diluted hydrochloric acid does not exceed 2 per cent. of the weight of Ceylon Cinnamon taken.

Uses.—Ceylon and Saigon cinnamon owe their virtues to a volatile oil. There are also present tannin, mannite, mucilage, sugar, etc. The tannin present often causes a fluidextract of cinnamon to gelatinize through its alteration. It is used as a stomachic in doses of four grains (0.25 Gm.) and also as a flavor.

OLEUM CASSIÆ. U. S. **Oil of Cinnamon**

[Ol. Cass.—OLEUM CINNAMOMI, U. S. P. VIII CASSIA OIL]

A volatile oil distilled from *Cinnamomum Cassia* (Nees) Blume (Fam. *Lauraceæ*), rectified by steam distillation and yielding not less than 80 per cent., by volume, of cinnamic aldehyde [$C_9H_8O = 132.06$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

Official Description.—A yellowish or brownish liquid, becoming darker and thicker by age and exposure to the air.

Odor and Taste.—Characteristic odor and taste of cinnamon.

Specific Gravity.—1.045 to 1.063 at 25° C. (77° F.).

Tests for Identity and Purity.—The optical rotation varies from +1° to −1° in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

Heavy Metals.—It does not respond to the Test for heavy metals in volatile oils (see U. S. P., Test No. 3, Chapter LXII).

Rosin.—Shake 2 mils of the Oil in a test tube with from 5 to 10 mils of purified petroleum benzin, and decant the latter; this liquid is colorless and does not assume a green color upon shaking it with an equal volume of (1 in 1000) copper acetate solution.

Assay.—Proceed as directed under *Oleum Cari*, using 10 mils of Oil of Cinnamon. It shows not less than 80 per cent., by volume, of cinnamic aldehyde.

U. S. P. Preparations.—Acidum Sulphuricum Aromaticum; Aqua Cinnamomi; Fluidextractum Cascaræ Sagradæ Aromaticum; Infusum Digitalis (from Water); Mistura Cretæ (from Water); Spiritus Cinnamomi; Syrupus Rhei (from Spirit).

N. F. Preparations.—Acetum Aromaticum; Elixir Cardamomi Compositum (from Compound Spirit); Elixir Glycyrrhizæ Aromaticum; Elixir Vanillini Compositum (from Compound Spirit); Fluidglyceratum Cascaræ Sagradæ Aromaticum; Liquor Pepsini Aromaticus; Mistura Guaiaci (from Water); Mistura Oleo-Balsamica; Nebula Aromatica; Nebula Mentholis Composita; Oleum Ricini Aromaticum; Spiritus Cardamomi Compositus; Spiritus Vanillini Compositus; Syrupus Ipecacuanhæ et Opii (from Spirit); Syrupus Rhamni Catharticæ; Trochisci Gambir.

There are two oils of cinnamon in commerce: one procured from the Ceylon cinnamon, the other from the Chinese cinnamon. The latter (*oil of cassia*) is now the only official one. The Chinese cinnamon is much the cheaper and more abundant of the two and will probably continue to be generally employed, notwithstanding the fact that the Ceylon product has the finer flavor. The value of cassia oil depends upon the percentage of cinnamic aldehyde which it contains. Cinnamyl acetate and cinnamic acid are also present, as well as small amounts of phenyl propyl acetate and orthocumaric aldehyde. In the oil of Ceylon cinnamon, cinnamic aldehyde is the chief constituent, but eugenol is present to the extent of over 5 per cent., and phellandrene has also been reported. Cinnamon leaf oil contains much eugenol and very little cinnamic aldehyde, safrol and benzaldehyde being present as minor constituents. Moderate oxidation of the oil yields the corresponding cinnamic acid, $C_9H_8O_2$, but by more energetic oxidation yields benzoic acid, $C_7H_6O_2$.

Oil of Ceylon cinnamon has a slightly acid reaction. Specific gravity between 1.024 and 1.040. It is readily soluble in alcohol, and contains between 65 and 75 per cent. of cinnamic aldehyde and from 4 to 8 per cent. of eugenol. When cooled to −10° C. (14° F.) it remains clear, but at a lower temperature a solid portion separates from it. *Oil of Chinese cinnamon* (oil of cassia) has similar properties, the marked difference being that its specific gravity is between 1.045 and 1.063, the aldehyde content being 80 per cent. or above, and that it contains no eugenol. The odor and taste are not quite so agreeable as that of the Ceylon variety.

Oil of Ceylon cinnamon when not very fresh contains cinnamic acid in sufficient quantity to give a permanent cloudiness to cinnamon water made from it. Dose, one minim (0.05 mil).

Cinnamic Aldehyde (C_9H_8O), known as *Synthetic Oil of Cassia*, was official in the U. S. P. VIII, but was not admitted to the ninth revision. It was described as an aldehyde obtained from Oil of Cinnamon or prepared synthetically, containing not less than 95 per cent. of pure cinnamic aldehyde $[C_6H_5.CH:CH.COH]$. It is nearly identical with the oil distilled from Cassia Cinnamon, and should be kept in small, amber-colored, well-stoppered bottles. This liquid is found in both oil of cassia and oil of Ceylon cinnamon, and can be separated by treatment with solution of sodium sulphite. It may also be made synthetically by saturating a mixture of acetaldehyde and benzaldehyde with hydrochloric acid gas. It is a colorless liquid. Optically inactive, with a cinnamon-like odor and burning, aromatic taste. The specific gravity is about 1.047 at 25° C. (77° F.). Sparingly soluble in water, miscible in all proportions with alcohol, ether and fixed and volatile oils. It boils at about 250° C. (482° F.), with partial decomposition. Cinnamic aldehyde should partially solidify when the temperature is reduced by a freezing mixture of ice and salt, and should melt again at −7.5° C. (18.5° F.).

If the looped end of a piece of clean copper wire be held in a non-luminous flame until it glows, then cooled, and the loop dipped into cinnamic aldehyde, ignited, and held so that the liquid burns outside of the flame, then if the loop be slowly brought in contact with the lower outer edge of the flame, no green tinge should be discernible (*chlorinated products*). It may be assayed as directed under the oil of cinnamon. Cinnamic aldehyde is often used to replace oil of cassia as a flavor.

Uses.—Oil of cinnamon is used as a flavor and to modify the action of griping or drastic drugs. Also used in flatulent colic. Dose one to three minims (0.06-0.2 mil).

Official Products from the Myrtaceæ

CARYOPHYLLUS. U. S. Clove

[**Caryoph.**—CLOVES]

The dried flower buds of *Eugenia aromatica* (Linné) O. Kuntze, *Jambosa Caryophyllus* (Sprengel) Niedenzu (Fam. *Myrtaceæ*), without the presence or admixture of more than 5 per cent. of the peduncles, stems or other foreign matter.

Official Description.—From 10 to 17.5 mm. in length, of a dark brown or brownish-black color, consisting of a stem-like, solid, inferior ovary, obscurely four-angled or somewhat compressed, terminated by four calyx teeth, and surmounted by a nearly globular head, consisting of four petals, which enclose numerous curved stamens and one style.

Odor and Taste.—Odor strongly aromatic; taste pungent and aromatic, followed by slight numbness.

When Clove is pressed strongly between the thumb-nail and finger, the volatile oil becomes visible.

Stems either separate or attached to the flower-buds; sub-cylindrical or four-angled, attaining a length of 25 mm. and a diameter of 4 mm., either simple, branching or distinctly jointed, and less aromatic than the flower-buds.

Tests for Identity and Purity.—The powder varies from dark brown to reddish-brown and consists chiefly of cellular fragments showing the large oil reservoirs, spiral tracheæ and a few somewhat thick-walled, slightly lignified, spindle-shaped bast-fibers; calcium oxalate in rosette aggregates, from 0.01 to 0.015 mm. in diameter; pollen grains numerous, tetrahedral, somewhat ellipsoidal, from 0.015 to 0.02 mm. in diameter. The presence of stems in the powder is shown by stone cells of irregular, polygonal shape, 0.07 mm. in diameter, with thick porous walls and large lumina, the latter frequently filled with a yellowish-brown amorphous substance.

Clove yields not less than 10 per cent. of volatile extractive soluble in ether (see U. S. P., Test No. 12, Chapter LXII).

Clove yields not more than 8 per cent. of ash. The amount of ash, insoluble in hydrochloric acid, does not exceed 0.5 per cent. of the weight of Clove taken.

U. S. P. Preparations.—Tinctura Lavandulæ Composita; Tinctura Rhei Aromatica.

N. F. Preparations.—Cordiale Rubi Fructus; Elixir Rubi Compositum; Pulvis Aromaticus Rubifaciens; Pulvis Cretæ Aromaticus; Pulvis Myricæ Compositus; Syrupus Sennæ Aromaticus; Tinctura Aromatica; Tinctura Opii Crocata; Tinctura Viburni Opuli Composita.

Cloves contain about 16 per cent. of volatile oil, 10 per cent. of tannin, *caryophyllin*, $C_{10}H_{16}O$, a crystalline principle, and *eugenin*, $C_{10}H_{12}O_2$, also crystalline.

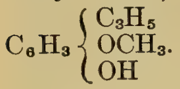
Uses.—It is used as an aromatic in doses of four grains (0.25 Gm.).

OLEUM CARYOPHYLLI. U. S. Oil of Clove

[**Ol. Caryoph.**—CLOVE OIL OIL OF CLOVES]

A volatile oil distilled from the flower-buds of *Eugenia aromatica* (Linné) O. Kuntze, *Jambosa Caryophyllus* (Sprengel) Niedenzu (Fam. *Myrtaceæ*), and yielding not less than 82 per cent., by volume, of eugenol [$C_{10}H_{12}O_2 = 164.10$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

Oil of clove, when recently distilled, is very fluid, clear, and colorless, but becomes yellowish by exposure, and ultimately reddish-brown. The oil of clove consists of two distinct oils, one lighter (a terpene) and the other heavier than water. They may be separated by distilling the oil from a solution of potassium hydroxide. The lighter comes over, the heavier remains combined with the potassium hydroxide, from which it may be separated by adding sulphuric acid and again distilling. *Light oil of clove* is colorless, is of the sp. gr. 0.918 and has the formula $C_{10}H_{16}$. It is said not to possess active properties. *Heavy oil of clove* is colorless at first, but darkens with age, has the odor and taste of cloves, is of the sp. gr. 1.079, boils at 243.3° C. (470° F.), and forms soluble and crystallizable salts with the alkalies. Oil of clove contains small amounts of vanillin, methyl alcohol and furfurol, but is mainly composed of an unsaturated phenol termed eugenol, which is now an official product, and its acetic derivative (see *Eugenol*) and a sesquiterpene *caryophyllene.* Eugenol acetyl salicylate has also been reported. The U. S. P. contains an assay process for the eugenol content. *Eugenol* has been shown to be the methyl ether of allyl-dioxybenzene,



$$C_6H_3\begin{cases}C_3H_5\\ OCH_3.\\ OH\end{cases}$$

One of its most important reactions is its conversion into *vanillin.* For this purpose it is boiled with acetic anhydride whereby *aceteugenol* is formed, which, oxidized in weak acid solution by potassium permanganate, yields *acetvanillic acid,* and this with weak potassium hydroxide solution is changed into vanillin, which is then extracted by acidifying and shaking up with ether. The characteristic aromatic odor of oil of cloves is due to *methyl-amylketone,* $CH_3.CO.C_5H_{11}$, which has been found to be present only in minute quantity. The proportion of eugenol in oil of clove is regarded as an index of the quality of the oil (see official assay below).

Official Description.—A colorless or pale yellow liquid, becoming darker and thicker by age and exposure to the air.

Odor and Taste.—Characteristic odor and taste of clove.

Solubility.—Soluble in 2 volumes of 70 per cent. alcohol.

Specific Gravity.—1.038 to 1.060 at 25° C. (77° F.).

Tests for Identity and Purity.—Its optical rotation does not exceed −1° 10′ in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

Phenol.—Shake 1 mil of the Oil with 20 mils of hot distilled water; the water shows not more than a scarcely perceptible acid reaction with litmus. After cooling, pass the aqueous layer through a wetted filter; the clear filtrate, with a drop of ferric chloride T.S., yields only a transient, grayish-green color, but not a blue or violet color.

Assay.—Introduce 10 mils of the Oil into a flask with a long graduated neck (cassia flask), add 50 mils of potassium hydroxide T.S., shake the mixture for five minutes and then heat it on a water bath during ten minutes, cool and when the liquids have separated completely, add sufficient potassium hydroxide T.S. to raise the lower limit of the oily layer within the graduated portion of the neck and note the volume of the residual liquid. This measures not more than 1.8 mils, indicating the presence of not less than 82 per cent., by volume, of eugenol.

N. F. Preparations.—Acetum Aromaticum; Elixir Cardamomi Compositum (from Compound Spirit); Elixir Glycyrrhizæ Aromaticum; Fluidglyceratum Cascaræ Sagradæ Aromaticum; Liquor Pepsini Aromaticus; Nebula Aromatica; Oleum Ricini Aromaticum; Pilulæ Colocynthidis Compositæ; Pilulæ Colocynthidis et Hyoscyami; Spiritus Cardamomi Compositus; Syrupus Eriodictyi Aromaticus; Tinctura Kino et Opii Composita.

Uses.—Oil of clove is largely used as a remedy for toothache. It produces relief if the pain is caused by an exposed nerve, and may be used by applying a little upon cotton to the affected nerve. Dose, three minims (0.2 mil).

EUGENOL. U. S. Eugenol

An unsaturated, aromatic phenol [$C_{10}H_{12}O_2$ or $C_6H_3.C_3H_5.OCH_3.OH$ 1:3:4 = 164.10] obtained from oil of clove and from other sources. Preserve it in well-closed containers, in a cool place, protected from light.

Preparation.—Eugenol is found in the volatile oils from clove, pimenta, bay leaves, Ceylon cinnamon, camphor, sassafras, massoy bark, canella, culilawan and others. It is principally obtained, however, from oil of clove. It may be made by treating oil of clove with an excess of solution of sodium hydroxide and shaking the mixture with ether to remove terpenes. The aqueous solution of sodium eugenol is decomposed by hydrochloric acid, and the eugenol purified by repeated washing.

Official Description.—A colorless or pale yellow, thin liquid. Exposure to air causes it to become darker and thicker.

Odor, Taste, and Reaction.—A strongly aromatic odor of clove, and a pungent and spicy taste. A mixture of 1 part of Eugenol and 20 parts of hot distilled water is only very slightly acid to litmus.

Solubility.—Miscible with alcohol, chloroform, ether or fixed oils; it is soluble in twice its volume of 70 per cent. alcohol.

Specific Gravity.—1.064 to 1.070 at 25° C. (77° F.).

Tests for Identity and Purity.—It boils between 250° and 255° C. (482° and 491° F.). It is optically inactive and strongly refractive.

Phenol.—Dissolve 1 mil of Eugenol in 12 mils of sodium hydroxide T.S. and add 18 mils of distilled water; a clear solution results, which becomes turbid when exposed to air. Shake 1 mil of Eugenol with 20 mils of distilled water and filter; 5 mils of the clear filtrate, upon the addition of 1 drop of ferric chloride T.S., shows a transient, grayish-green color, but not a blue or violet color.

N. F. Preparation.—Mistura Oleo-Balsamica.

Uses.—Eugenol is used extensively to replace oil of clove. It is used for similar purposes (see above). The dose is three minims (0.2 mil).

Official Products from the Myristicaceæ

OLEUM MYRCIÆ. N. F. Oil of Myrcia

[Ol. Myrc.—Oil of Bay]

A volatile oil distilled from the leaves of *Pimenta acris* (Swartz) Wight (Fam. *Myrtaceæ*). Preserve it in small, well-stoppered, amber-colored bottles, in a cool place, protected from light.

Official Description.—A yellow or brownish-yellow liquid.

Odor, Taste, and Reaction.—A pleasant, aromatic odor and a pungent, spicy taste. An alcoholic solution is slightly acid to litmus paper.

Solubility.—With an equal volume of alcohol, glacial acetic acid, or carbon disulphide, it yields slightly turbid solutions.

Specific Gravity.—0.962 to 0.990 at 25° C. (77° F.).

Tests for Identity and Purity.—It is lævorotatory, the angle of rotation not exceeding $-3°$, in a 100-mm. tube, at 25° C. (77° F.).

When mixed with an equal volume of a concentrated solution of sodium hydroxide, it forms a semi-solid mass.

Dissolve 2 drops of the Oil in 4 mils of alcohol, and add a drop of ferric chloride T.S.; a light green color is produced; if the same test is made with a drop of dilute ferric chloride T.S., prepared by diluting the test solution with 4 times its volume of distilled water, a light bluish coloration is produced, which soon disappears.

To 3 drops of the Oil, contained in a small test tube, add 3 drops of sulphuric acid, cork the test tube and allow the mixture to stand for half an hour; a resinous mass is obtained. Add 4 mils of diluted alcohol to this mass, vigorously shake the mixture, and gradually heat on a water bath to the boiling point; the liquid remains nearly colorless, and does not acquire a red or purplish-red color (distinction from *oil of pimenta or oil of clove*).

Phenol.—Shake 1 mil of the Oil with 20 mils of hot distilled water and filter; the filtered aqueous solution does not give more than a scarcely perceptible acid reaction with litmus paper and on adding a drop of ferric chloride T.S. it yields only a transient, grayish-green but not a blue or violet color.

N. F. Preparation.—Spiritus Myrciæ Compositus.

Uses.—A perfume, used chiefly in preparation of *Bay Rum.* (See page 392.)

PIMENTA. N. F. Pimenta

(U. S. P. VIII)

[Piment. ALLSPICE]

The dried, nearly ripe fruit of *Pimenta officinalis* Lindley (Fam. *Myrtaceæ*), without the presence of more than 5 per cent. of stems or other foreign matter.

Official Description.—Sub-globular, from 4 to 7 mm. in diameter, summits with four calyx teeth forming a minute ring; externally dark brown, somewhat rough and glandular-punctate; pericarp brittle, about 1 mm. in thickness; two-celled and two-seeded; dissepiments thin; seeds plano-convex, slightly reniform, externally reddish-brown, smooth, somewhat wrinkled and shiny.

Odor and Taste.—Odor and taste, particularly of the pericarp, aromatic and distinctive.

Tests for Identity and Purity.—The powder is reddish-brown or dark brown and, when examined under the microscope, shows irregular fragments and numerous starch grains, the latter being either simple or compound, the individual grains spherical, from 0.003 to 0.015 mm. in diameter, plano-convex or polygonal, and frequently with a central circular marking or cleft; stone cells numerous, of tabular, pyriform or variable shape and with thick, porous, and strongly lignified walls, the lumina frequently filled with a yellowish- or reddish-brown amorphous substance, fragments with oil secretion reservoirs containing globules of a yellowish-brown oil; parenchyma cells with reddish-brown tannin masses. Stem fragments very few, and characterized by more or less curved, thick-walled, non-glandular hairs, rosette aggregates of calcium oxalate, from 0.006 to 0.017 mm. in diameter, tracheid-like tissues of the wood and long, narrow bast-fibers.

The yield of crude fiber does not exceed 25 per cent. when estimated as directed in the U. S. P., Test No. 11, Chapter LXII.

Pimenta yields not more than 6 per cent. of ash.

N. F. Preparation.—Tinctura Guaiaci Composita.

Uses.—This aromatic fruit contains about 3 per cent. of volatile oil, with tannin, fat, resin, gum, sugar, etc. It is used chiefly in medicine as an adjuvant to tonics and purgatives. The dose is fifteen grains (1 Gm.).

OLEUM PIMENTÆ. U. S. Oil of Pimenta

[Ol. Piment.—PIMENTO OIL OIL OF ALLSPICE]

A volatile oil distilled from the fruit of *Pimenta officinalis* Lindley (Fam. *Myrtaceæ*), yielding not less than 65 per cent., by volume, of eugenol [$C_{10}H_{12}O_2 = 164.10$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

Official Description.—A colorless, yellow or reddish liquid, becoming darker with age.

Odor and Taste.—Characteristic odor and taste of allspice.

Solubility.—Soluble in an equal volume of 90 per cent. alcohol; also soluble in 2 volumes of 70 per cent. alcohol.

Specific Gravity.—1.018 to 1.048 at 25° C. (77° F.).

Tests for Identity and Purity.—The optical rotation varies from 0° to −4° in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

Assay.—Proceed as directed under *Oleum Caryophylli*, using 10 mils of Oil of Pimenta. The residual liquid measures not more than 3.5 mils, indicating the presence of not less than 65 per cent., by volume, of eugenol.

N. F. Preparations.—Liquor Pepsini Aromaticus; Spiritus Myrciæ Compositus.

Uses.—The oil is used as a stimulant and carminative in doses of three minims (0.2 mil).

VANILLA. N. F. Vanilla

(U. S. P. VIII)

[VANILLA BEAN]

The cured, full-grown, unripe fruit of *Vanilla planifolia* Andrews (Fam. *Orchidaceæ*).

This valuable drug contains a trace of a volatile oil, 10 per cent. of fixed oil, resin, sugar, etc., and *vanillin*, $C_8H_8O_3$, which is the aldehyde of methylprotocatechuic acid, and is now official. (See page 1145.)

The agreeable odor and taste of "vanilla bean" is due to a fermentation occurring during the curing process; the fruit when first plucked from the plant has little odor or taste.

Official Description.—Pods linear, flattened, from 15 to 35 cm. in length and from 5 to 9 mm. in breadth; summits terminating in flat circular scars; gradually tapering, more or less bent and curved or hooked at the bases, or in the Tahiti variety, broad in the middle and tapering towards either end, the base closely resembling the summit; externally blackish-brown, longitudinally wrinkled, moist-glossy; occasionally with an efflorescence of vanillin in the form of acicular crystals or monoclinic prisms; frequently with narrow, elliptical or irregular, more or less wrinkled, dark-brown patches of cork; occasionally split into three parts near the tip, flexible and tough, one-celled, containing a blackish-brown pulp and numerous blackish-brown seeds; the latter being flattened, irregularly triangulate or nearly circular in outline, reticulate and varying from 0.25 to 0.3 mm. in diameter.

Odor and Taste.—Characteristic and very agreeable.

Tests for Identity and Purity.—Under the microscope, transverse sections of the pods of Vanilla show an epidermis with a somewhat thickened outer cuticularized layer having occasionally rounded or conical masses of an excretion of a gum-like substance; a layer of collenchyma of one or two rows of cells; a thick sarcocarp composed of parenchyma cells in which are imbedded an interrupted circle of fibro-vascular bundles; the parenchyma cells are deeply undulate in outline and usually contain a thin protoplasmic layer enclosing numerous oily globules or may contain bundles of raphides of calcium oxalate; the individual crystals varying from 0.2 to 0.4 mm. in length; some of the parenchyma cells are specially modified and distinguished by their somewhat thickened walls with long, oblique, slit-like pores or the thickening may extend in the form of broad spiral bands; in the fibro-vascular bundles the phloem is central, being more or less surrounded by a few tracheæ, the walls possessing slit-like pores or spiral thickenings, and at the outside of the bundle is a closed circle of sclerenchymatous fibers, the walls being thin, strongly lignified, provided with numerous, transverse, simple pores, the outer wall of the outer row of fibers being irregular or sinuate; from the inner walls of the endocarp arise the placentæ bearing numerous brownish-red or blackish seeds, and from the cells of the endocarp also arise numerous long, nearly straight hairs, the ends being rounded, the hairs being more or less matted together by a gummy or resinous mass in which some of the seeds are held; in mounts made in hydrated chloral T.S. or potassium hydroxide T.S., the immature, brownish-red seeds show a deeply reticulate seed-coat, with cells of an oblong-polygonal form in surface view.

Place a few of the crystals, occurring as an efflorescence on the fruit, on a microscope slide or watch crystal and add a drop of phloroglucinol T.S. and hydrochloric acid; the solution immediately acquires a carmine-red color (distinction from *benzoic acid*).

The amount of extractive yielded to dilute alcohol should not be less than 12 per cent.

Vanilla yields not more than 6 per cent. of ash.

N. F. Preparations.—Elixir Ammonii Valeratis (from Tincture); Elixir Humuli (from Tincture); Elixir Strychninæ Valeratis (from Tincture); Syrupus Bromidorum (from Tincture); Tinctura Vanillæ.

Uses.—It is sometimes used as a stimulant, carminative and antihysteric, but its chief use is as a flavor and perfume.

VANILLINUM. U. S. Vanillin

[Vanillin.]

Methylprotocatechuic aldehyde [$C_8H_8O_3$ or $C_6H_3.OH.OCH_3.COH$ 4:3:1 = 152.06] occurring naturally in vanilla, or prepared synthetically. Preserve it in well-closed containers, protected from light.

Preparation.—Vanillin may be obtained from vanilla, which contains from 2 to 3 per cent. It is also found in many substances, and in the tissues of certain plants, in crude beet sugar, asparagus, and even in asafetida. The vanillin of commerce is made artificially, and, while chemically identical with the product obtained from the "vanilla bean," owing to the fact that the vanilla contains other odorous products, "extract of vanilla," made from vanillin, never equals in flavor the preparation in which vanilla alone is used. Vanillin is made synthetically by oxidizing either coniferin or eugenol, by treating guaiacol with chloroform in the presence of an alkali, and by other methods. It is frequently adulterated. Some of the substances which have been detected are acetanilid, boric acid, benzoic acid, sugar, acetico-eugenol, and coumarin.

Official Description.—It occurs in fine, white, or only very slightly yellowish, crystalline needles.

Odor, Taste, and Reaction.—Odor and taste of vanilla. Its aqueous solution is acid to litmus and is optically inactive.

Solubility.—One Gm. of Vanillin dissolves in 100 mils of water at 25° C. (77° F.); also in 16 mils of water at 80° C. (176° F.); freely soluble in alcohol, glycerin, chloroform, or ether.

Tests for Identity and Purity.—It melts between 80° and 82° C. (176° and 179.6° F.).

It is easily dissolved by aqueous solutions of the alkali hydroxides, and from the combinations thus formed it is precipitated at once by the addition of acids.

An aqueous solution of Vanillin gives a blue color with ferric chloride T.S.; if the mixture is boiled, the blue color changes to brown, and on cooling a white, or nearly white, precipitate of dihydrodivanillin separates.

Vanillin is extracted completely from its solution in ether by shaking with a saturated, aqueous solution of sodium bisulphite, from which it is precipitated by the addition of sulphuric acid.

A cold aqueous solution of Vanillin gives, on the addition of lead acetate T.S., a white precipitate of a lead compound of vanillin, soluble in hot water.

Incinerate about 2 Gm. of Vanillin; not more than 0.05 per cent. of ash remains.

Acetanilid.—Warm about 0.1 Gm. of Vanillin with a concentrated alcoholic solution of sodium hydroxide, add a drop of chloroform and again warm; the odor of phenylisocyanide is not perceptible.

N. F. Preparations.—Elixir Amygdalæ Compositum; Elixir Vanillini Compositum (from Compound Spirit); Liquor Ferri Peptonati; Liquor Ferri Peptonati et Mangani; Oleum Ricini Aromaticum; Spiritus Vanillini Compositus; Trochisci Carbonis Ligni; Trochisci Phenolphthaleini; Trochisci Quininæ Tannatis; Trochisci Santonini; Trochisci Santonini Compositi.

Uses.—Vanillin is used as a flavoring agent. It is sometimes given internally for dyspepsia in the dose of one-half to one grain (0.03 to 0.65 Gm.).

COUMARINUM. N. F. Coumarin

[Coumar.]

The anhydride [$C_6H_4(CH)_2OCO$ = 146.05] of ortho-oxycinnamic acid, occurring naturally in Tonka, Melilot and other plants, or prepared synthetically.

Official Description.—It occurs in colorless, prismatic crystals.

Odor and Taste.—Characteristic, fragrant odor and a bitter, aromatic and burning taste.

Solubility.—Sparingly soluble in cold water, more readily soluble in hot water, freely soluble in alcohol, ether, or chloroform; also soluble in fixed or volatile oils.

Tests for Identity and Purity.—When heated to between 67° and 68° C. (152.6° and 154.4° F.) it melts, and at about 100° C. (212° F.) it commences to sublime; at from 290° to 291° C. (554°–555.8° F.) it boils without decomposition.

Coumarin dissolves in solution of sodium or potassium hydroxide, producing a yellow color and forming sodium or potassium coumarate, from which carbon dioxide precipitates the Coumarin. Coumarin is precipitated in colorless needles on the addition of hydrochloric acid to its hot concentrated sodium or potassium hydroxide solution.

A saturated aqueous solution of Coumarin forms a precipitate upon the addition of iodine T.S. The precipitate is at first brown and flocculent and afterwards, on shaking, clots together, forming a dark green curdy mass and leaving the liquid clear (distinction from *vanillin*).

Coumarin is not extracted from its solution in ether by ammonia water (distinction from *vanillin*).

Acetanilid.—Warm 0.1 Gm. of Coumarin with 1 mil of an alcoholic solution of sodium hydroxide (1 in 4), add a few drops of chloroform and again warm; the mixture does not possess the disagreeable odor of phenyl-isocyanide.

N. F. Preparations.—Iodoformum Aromatisatum; Oleum Ricini Aromaticum.

Uses.—As a flavor, fixative, and perfume, having the odor of *new-mown hay*.

OLEUM CAJUPUTI. U. S. Oil of Cajuput

[**Ol. Cajup.**—Cajuput Oil Oil of Cajuput]

A volatile oil distilled from the fresh leaves and twigs of several varieties of *Melaleuca Leucadendron* Linné, especially the var. *Cajuputi* Roxburgh and the var. *minor* Smith (Fam. *Myrtaceæ*). Preserve it in well-stoppered, amber-colored bottles, in a cool place.

This aromatic oil has a penetrating odor, analogous to that of cardamom, and a warm, pungent taste. Its chief constituent has the formula $C_{10}H_{18}O$, and by repeated distillation over phosphoric oxide the hydrocarbon, $C_{10}H_{16}$, called *cajuputene*, can be obtained. The oil is, therefore, said to contain *cajuputene hydrate*, or *cajuputol*. The identity of cajuputol with *cineol* and *eucalyptol* from *Eucalyptus Globulus* in both chemical and physical properties has been established. It boils at 175° C. (347° F.). A second constituent of the formula $C_{10}H_{18}O$ is the solid *terpineol*, which is present both in the free state and as acetic ester. A small amount of *l-pinene* and traces of aldehydes have been found, including *valeraldehyde* and *benzaldehyde*. When oil of cajuput is distilled, a light, colorless liquid first comes over, and afterwards a green and denser one. The green color has been ascribed to a salt of copper derived from the vessels in which the distillation is performed, and various investigators have found traces of copper present in it. Others, again, have carefully tested the green oil and proved its absence. A fair inference is that the oil of cajuput is naturally green, but that as found in commerce it sometimes contains copper, either accidentally present, or added with a view of imitating or maintaining the fine color of the oil.

Official Description.—A colorless or yellowish liquid.

Odor and Taste.—It has a peculiar, agreeable, distinctly camphoraceous odor, and an aromatic, slightly bitter taste.

Solubility.—Soluble in 1 volume of 80 per cent. alcohol.

Specific Gravity.—0.912 to 0.925 at 25° C. (77° F.).

Tests for Identity and Purity.—Its optical rotation does not exceed -4° in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

Heavy Metals.—It does not respond to the Test for heavy metals in volatile oils (see U. S. P., Test No. 3, Chapter LXII).

N. F. Preparation.—Linimentum Tiglii.

Uses.—Oil of cajuput is a stimulant, and is given in doses of eight minims (0.5 mil).

EUCALYPTUS. U. S. Eucalyptus
[Eucalypt.—Blue Gum Leaves]

The dried leaves of *Eucalyptus Globulus* Labillardière (Fam. *Myrtaceœ*), collected from the older parts of the tree, without the presence or admixture of more than 3 per cent. of the stems, fruits or other foreign matter.

Official Description.—Laminæ lanceolately scythe-shaped, from 8 to 30 cm. in length and from 2 to 7.5 cm. in breadth; summits when present acute or acuminate; bases unequal, obtuse or more or less rounded and connected with a twisted petiole from 5 to 35 mm. in length; margins slightly uneven, revolute; coriaceous; both surfaces varying from pale yellowish-green to grayish-green and more or less glaucous, glabrous, glandular-punctate and with numerous small, circular, brown dots of cork; veins of the first order anastomosing with each other and forming a line nearly parallel with the margin.

Odor and Taste.—Odor slightly aromatic; taste aromatic, bitter, and cooling.

Tests for Identity and Purity.—Under the microscope, sections of Eucalyptus show the upper and lower surfaces with nearly similar cells, the outer walls being strongly cuticularized; stomata occur on both surfaces, a region of palisade cells made up of from 3 to 4 rows of cells occurring beneath each surface; among the palisade cells occur large oil-secretion reservoirs, with a yellowish or orange colored oily content; calcium oxalate crystals in cells of the loose mesophyll in the form of rosette aggregates or monoclinic prisms varying from 0.015 to 0.025 mm. in diameter. At the periphery of the fibrovascular bundles of the midrib and petiole occurs a more or less interrupted circle of small groups of slightly lignified bast-fibers.

U. S. P. Preparation.—Fluidextractum Eucalypti.

The virtues of eucalyptus leaves depend upon a volatile oil which should contain about 70 per cent. of eucalyptol. There are also present resin, tannin, chlorophyll, fatty acid, etc.

Uses.—The leaves are used as a stimulant, febrifuge, or astringent. Dose, thirty grains (2 Gm.).

OLEUM EUCALYPTI. U. S. Oil of Eucalyptus
[Ol. Eucalypt.—Eucalyptus Oil]

A volatile oil distilled from the fresh leaves of *Eucalyptus Globulus* Labillardière (Fam. *Myrtaceœ*) or from some other species of *Eucalyptus* and yielding not less than 70 per cent., by volume, of eucalyptol (cineol) [$C_{10}H_{18}O = 154.14$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

The oil from eucalyptus globulus contains *pinene*, $C_{10}H_{16}$, and *eucalyptol* (or *cineol*), $C_{10}H_{18}O$, also several of the aldehydes of the fatty series, notably *valeraldehyde*, and probably *butyraldehyde* and *capronaldehyde*. The most valuable portion of the oil consists of *eucalyptol*, which is very soluble in alcohol. The proportion of eucalyptol is recognized as a useful test for the quality of the oil (see official assay below).

Official Description.—A colorless or pale yellow liquid.

Odor and Taste.—Characteristic, aromatic, somewhat camphoraceous odor, and a pungent, spicy, and cooling taste.

Solubility.—Soluble in 4 volumes of 70 per cent. alcohol.

Specific Gravity.—0.905 to 0.925 at 25° C. (77° F.).

Tests for Identity and Purity.—*Other Eucalyptus Oils Containing Large Amounts of Phellandrene.*—Mix 2 mils of the Oil with 4 mils of glacial acetic acid and gradually add 3 mils of a saturated solution of sodium nitrite. When gently stirred, the mixture does not form crystals of phellandrene nitrite.

Assay.—Measure 10 mils of the Oil, from a pipette, into a round-bottom glass dish of 50 mils capacity, which is imbedded in finely broken ice. Add 10 mils of arsenic acid T.S. and stir until precipitation is complete. When the mixture ceases to congeal further, allow it to stand for ten minutes in the ice bath. (If at this point a hard mass is formed, add 5 mils of purified petroleum benzin, and mix the mass well before proceeding with the assay.) Then transfer it immediately to a hardened filter paper, about 18.5 cm. in diameter, by means of a pliable horn spatula; spread it evenly over the surface of the paper and lay a second hardened filter paper over the top. Wrap several thicknesses of absorbent or filter paper around the hardened filters, and place the whole between the plates of a press and bring to bear all the pressure possible for about one minute. Change the outside absorbent papers and press again, repeating the operation, if necessary, until the eucalyptol arsenate is apparently dry, and separates readily when touched with a spatula. The pressing is not complete when a hard mass remains which is broken up with difficulty; and usually two changes of filter paper are required, pressing each time for about two minutes; if left too long in the press the compound may decompose. Now, transfer the compound completely by means of the horn spatula to a glass funnel inserted into a 100-mil cassia flask with a neck graduated to 10 mils into tenths. Wash the last portions of the precipitate into the flask with a stream of hot distilled water from a wash bottle, assisting the disintegration with a glass rod, place the flask in boiling water and rotate it until the compound is thoroughly broken up. Then add enough distilled water to cause the eucalyptol to rise into the neck of the flask, cool it to room temperature and read its volume. This volume, multiplied by 10, shows the percentage of eucalyptol (cineol) in the Oil.

Uses.—Oil of eucalyptus is used as a stimulant in doses of eight minims (0.5 mil). Eucalyptol is frequently preferred to it (see below).

EUCALYPTOL. U. S. Eucalyptol

[CINEOL]

An organic compound [$C_{10}H_{18}O = 154.14$] obtained from the volatile oil of *Eucalyptus Globulus* Labillardière (Fam. *Myrtaceæ*) and from other sources. Preserve it in well-closed containers, in a cool place, protected from light.

Preparation.—Eucalyptol may be obtained from many volatile oils, and chemists prefer to call it cineol. It may be separated from the purified volatile oils by taking advantage of its property of forming crystals when subjected to a low temperature (–1° C.; 30.2° F.)

Official Description.—A colorless liquid.

Odor and Taste.—Characteristic, aromatic and distinctly camphoraceous odor, and a pungent, spicy taste; it produces a cooling sensation in the mouth.

Solubility.—Very slightly soluble in water, miscible with alcohol, chloroform, ether, glacial acetic acid, or fixed or volatile oils.

Specific Gravity.—0.921 to 0.923 at 25° C. (77° F.).

Tests for Identity and Purity.—It boils between 174° and 177° C. (345.2° and 350.6° F.).

Congealing point: not below 0° C. (32° F.).

Eucalyptol is optically inactive (distinction from *oil of eucalyptus and many other volatile oils.*)

Place 1 mil of Eucalyptol in a freezing mixture and gradually add to it an equal volume of phosphoric acid; a solid, white, crystalline mass of cineol-phosphoric acid results, and if warm water is then added, the Eucalyptol separates.

Saponifiable Oils.—Shake 5 mils of Eucalyptol with 5 mils of sodium hydroxide T.S.; the volume of the Eucalyptol is not diminished.

Phenols.—Its alcoholic solution (1 in 10) is neutral to moistened litmus paper, and, on adding a drop of ferric chloride T.S. to 5 mils of this solution, no brown or violet color is produced.

N. F. Preparations.—Liquor Antisepticus; Liquor Antisepticus Alkalinus; Liquor Pepsini Antisepticus; Nebula Aromatica; Nebula Eucalyptolis; Nebula Mentholis Composita; Petroxolinum Eucalyptolis; Petroxolinum Iodoformi; Petroxolinum Sulphuratum Compositum; Pulvis Antisepticus.

Uses.—Eucalyptol is used in the N. F. antiseptic solutions, and is a stimulant and antiseptic. Dose, five minims (0.3 mil).

MYRISTICA. U. S. Myristica

[Myrist.—NUTMEG]

The ripe seeds of *Myristica fragrans* Houttuyn (Fam. *Myristicaceæ*), deprived of the arilli and seed-coats. Preserve the kernels in tightly closed containers, adding a few drops of carbon tetrachloride or chloroform from time to time to prevent attack by insects. Reject broken or wormy kernels.

Official Description.—Ovoid or ellipsoidal, from 20 to 30 mm. in length and about 20 mm. in thickness; externally light brown to dark brown, reticulately furrowed, the broad end with a large, circular, upraised scar from which arises a furrow extending to the chalaza; easily cut, the surface having a waxy luster and mottled by reason of the light brown perisperm penetrating into the yellowish-brown endosperm; a longitudinal section through the endosperm above the large scar shows a small, irregular cavity with the more or less shrunken remains of the embryo, and usually containing a growth of mold.

Odor and Taste.—Odor and taste agreeably aromatic.

Tests for Identity and Purity.—The powder is dark reddish-brown; consisting of irregular, yellowish-brown or brownish-black fragments; fragments of perisperm yellowish-brown with large, circular or elliptical oil reservoirs containing a volatile oil, small, thin-walled parenchyma cells, and occasional spiral tracheæ; parenchyma cells of endosperm more or less polygonal and filled with starch grains and aleurone grains; starch grains single or compound, the individual grains being spherical, plano-convex or polygonal, from 0.003 to 0.02 mm. in diameter and colored blue with iodine T.S. (distinction from starch grains in mace, which are colored yellowish-red); mounts in hydrated chloral T.S. show numerous globules of a fixed oil which later may separate in the form of rod-like crystals; mounts in fixed oil show the separation of spheroidal aggregates of crystals which polarize light strongly. The powder made from "limed" nutmegs shows under the microscope, upon the addition of water containing 25 per cent. of sulphuric acid, the immediate separation of crystals of calcium sulphate in the form of small needles or short rods which do not polarize light.

Myristica yields not more than 5 per cent. of ash.

U. S. P. Preparations.—Fluidextractum Aromaticum (from Aromatic Powder); Pulvis Aromaticus; Tinctura Lavandulæ Composita; Tinctura Rhei Composita; Trochisci Sodii Bicarbonatis.

N. F. Preparations.—Acetum Opii; Cordiale Rubi Fructus; Pulvis Cretæ Compositus; Syrupus Sennæ Aromaticus.

Uses.—This valuable spice owes its activity to the presence of an oxygenated volatile oil. Nutmeg contains about 25 per cent. of fixed oil, with proteids, starch, etc. It is used as a stimulating aromatic and flavor. Dose, eight grains (0.5 Gm.).

OLEUM MYRISTICÆ. U. S. Oil of Myristica

[Ol. Myrist.—MYRISTICA OIL OIL OF NUTMEG]

A volatile oil distilled from the kernel of the ripe seed of *Myristica fragrans* Houttuyn (Fam. *Myristicaceæ*). Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

This oil consists chiefly of pinene, with probably some dipentene, also *myristicol*, $C_{10}H_{16}O$ and *myristicin*, $C_{11}H_{12}O$, linalool, borneols, terpineol, geraniol, eugenol, and a number of organic acids.

Expressed oil of nutmeg, or *oil of mace*, is made by expressing nutmegs between hot plates, or macerating them in carbon disulphide, and distilling the macerate. It has been identified as the glyceride of myristic acid, $C_{14}H_{28}O_2$, and had, therefore, the formula $C_3H_5(C_{14}H_{27}O_2)_3$. Besides *myristin*, or the solid fat, there is present about an equal amount of a liquid fat containing free acid.

Official Description.—A colorless or pale yellow liquid.

Odor and Taste.—Characteristic odor and taste of nutmeg.

Solubility.—Soluble in an equal volume of alcohol; also soluble in 3 volumes of 90 per cent. alcohol.

Specific Gravity.—0.859 to 0.924 at 25° C. (77° F.).

Tests for Identity and Purity.—The optical rotation varies from +12° to +30° in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

Evaporate 3 Gm. of the Oil on a water bath; not more than 0.06 Gm. of residue remains.

U. S. P. Preparation.—Spiritus Ammoniæ Aromaticus.

N. F. Preparations.—Elixir Glycyrrhizæ Aromaticum; Elixir Pepsini et Rennini Compositum; Mistura Oleo-Balsamica.

Uses.—It is used in aromatic spirit of ammonia. This oil is very difficult to keep and even if slightly terebinthinate is unfit for flavoring purposes. Dose, three minims (0.2 mil).

MACIS. N. F. Mace

The arillode of the seed of *Myristica fragrans* Houttuyn (Fam. *Myristicaceæ*).

It contains from 7 to 9 per cent. of a volatile oil which consists chiefly of *pinene* with some *myristicin*, $C_{12}H_{14}O_3$.

Official Description.—In narrow bands, 25 mm. or more in length, somewhat branched and lobed above, united into broader bands below; yellowish to brownish-orange, and oily.

Odor and Taste.—Odor fragrant; taste warm and aromatic.

Tests for Identity and Purity.—The powder is orange-buff to orange-brown. Mounted in water and examined microscopically, the powder exhibits elongated epidermal cells; parenchyma containing very small amylodextrin granules, which are colored red-brown by iodine T.S.; large oil cells, the contents of which are not greatly changed in color on the addition of alkali.

Powdered false Mace or Bombay Mace is yellow-brown to deep-brown in color and deficient in odor and taste. When mounted in water and examined microscopically it exhibits flattened, thick-walled epidermal cells and oil cells much more numerous than in true Mace and containing an orange-red resinous substance which is dissolved by alkalies, forming a blood-red liquid.

Moisten Mace with hydrochloric acid; no greenish color is produced (difference from and absence of the *arillode of Myristica Malabarica* Lamarck *or Bombay Mace*).

Add potassium chromate T.S. to an alcoholic tincture of Mace (1 in 10); the precipitate formed is yellow and does not change to red on standing, nor does the solution develop a red coloration (difference from and absence of *Bombay Mace*).

Saturate a piece of filter paper with an alcoholic tincture of Mace (1 in 10), and add one drop of potassium hydroxide T.S.; no blood-red coloration is produced (difference from and absence of *Bombay Mace*).

Mace yields not less than 8 per cent. of volatile ether extract, and not less than 20 per cent. nor more than 30 per cent. of non-volatile ether extract.

Mace yields not more than 3 per cent. of ash, which is almost completely soluble in hydrochloric acid.

N. F. Preparation.—Elixir Rubi Compositum.

Uses.—Used as a flavor and aromatic; dose, eight grains (0.5 Gm.).

Offcial Products from the Lauraceæ

SASSAFRAS. U. S. Sassafras

[Sassaf.]

The bark of the root of *Sassafras variifolium* (Salisbury) O. Kuntze (Fam. *Lauraceæ*), without the presence or admixture of more than 2 per cent. of adhering wood, collected in the early spring or autumn, deprived of the outer corky layer and dried.

Official Description.—In irregularly transversely curved or quilled pieces, from 1 to 15 cm. in length and from 1 to 4 mm. in thickness; outer surface orange-brown, nearly smooth and marked with more or less irregular ridges; inner surface light to dark reddish-brown, obscurely short-striate; fracture short with a thin reddish-brown corky layer and a yellowish-white inner bark.

Odor and Taste.—Odor aromatic; taste slightly mucilaginous, astringent, aromatic and somewhat pungent.

Tests for Identity and Purity.—The powder is light reddish-brown; when examined under the microscope it exhibits numerous starch grains and prominent, characteristic bast-fibers; starch grains either single or 2- to 4-compound, the individual grains being more or less spherical or polygonal and frequently with a distinct cleft, from 0.003 to 0.02 mm. in diameter, some of the swollen or altered grains attaining a diameter of 0.03 mm.; bast-fibers spindle-shaped, occasionally very irregular in outline, with sharply pointed ends, from 0.15 to 0.4 mm. in length, about 0.025 mm. in diameter, and with very thick, strongly lignified walls, the lamina being frequently nearly obliterated; parenchyma cells containing either starch grains or irregular yellowish-red masses of tannin and becoming bluish-black upon the addition of ferric chloride T.S.; fragments of wood few, with large, thin-walled tracheæ marked by simple pores and associated with rather thin-walled wood-fibers.

Sassafras yields not more than 30 per cent. of ash.

U. S. P. Preparation.—Fluidextractum Sarsaparillæ Compositum.

N. F. Preparations.—Decoctum Sarsaparillæ Compositum; Syrupus Pini Strobi Compositus; Syrupus Pini Strobi Compositus cum Morphina.

This well known bark contains volatile oil (safrol), sassafrid, tannin, starch, resin, etc.

Uses.—It is principally used on account of its aromatic oil, largely in domestic practice, and as an addition to proprietary medicines for the purpose of covering the taste of disagreeable substances. Dose, two and one-half drachms (10 Gm.).

OLEUM SASSAFRAS. U. S. Oil of Sassafras

[**Ol. Sassaf.**—SASSAFRAS OIL]

A volatile oil distilled from the root of *Sassafras variifolium* (Salisbury) O. Kuntze (Fam. *Lauraceæ*). Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

This oil was formerly largely produced in New Jersey and Maryland from the wood and bark of the sassafras; the yield is about 2 per cent. It consists of a terpene, $C_{10}H_{16}$ (*safrene*), and an oxygenated portion, $C_{10}H_{10}O_2$. *Safrol*, which was official in the U. S. P. VIII, is the methylene ether of allyl pyrocatechol and is made on a large scale by chilling the oils of camphor and sassafras, and also some other oils; the crystals are separated, and allowed to melt, forming liquid safrol. It has also been made synthetically. It is a colorless or faintly yellow liquid of a sassafras-like odor. Specific gravity, 1.098 to 1.100 at 25° C. (77° F.). It is soluble in about an equal volume of strong alcohol, and in about 30 parts of 70 per cent. alcohol. Miscible in all proportions with ether and chloroform. Boiling point: about 233° C. (451.4° F.); optically inactive. On cooling to –20° C. (–4° F.) or below, it solidifies to a mass of crystals, which do not melt below 11° C. (51.8° F.). It is used for scenting soaps and as a substitute for oil of sassafras.

The oil is officially described as follows :

Official Description.—A yellow or reddish-yellow liquid.

Odor and Taste.—Characteristic odor and taste of sassafras.

Solubility.—Soluble in 2 volumes of 90 per cent. alcohol, forming a solution neutral to litmus.

Specific Gravity.—1.065 to 1.077 at 25° C. (77° F.).

Tests for Identity and Purity.—The optical rotation varies from +3° to +4° in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

U. S. P. Preparations.—Syrupus Sarsaparillæ Compositus; Trochisci Cubebæ; Linimentum Tiglii Compositum.

N. F. Preparations.—Mistura Opii et Sassafras; Syrupus Eriodictyi Aromaticus; Syrupus Morphinæ et Acaciæ; Syrupus Pini Strobi Compositus; Syrupus Pini Strobi Compositus cum Morphina.

Uses.—Oil of sassafras is largely used as a flavoring agent by confectioners. The official preparations are given above. It may be given in the dose of three minims (0.2 mil).

Official Products from the Betulaceæ

METHYLIS SALICYLAS. U. S. Methyl Salicylate

[**Methyl. Salicyl.**—OLEUM GAULTHERIÆ, U. S. P. VIII OIL OF WINTERGREEN OLEUM BETULÆ, U. S. P. VIII OIL OF SWEET BIRCH OIL OF TEABERRY]

It contains not less than 98 per cent. of $CH_3C_7H_5O_3$ (152.06). It is produced synthetically or is obtained by distillation from *Gaultheria procumbens* Linné (Fam. *Ericaceæ*) or from *Betula lenta* Linné (Fam. *Betulaceæ*). The label must indicate whether the methyl salicylate has been synthetically made or distilled from either of the above mentioned plants. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

Preparation.—In the U. S. P. IX, Oil of Gaultheria, Oil of Betula, and Methyl Salicylate were combined under the latter title, as it is difficult to distinguish between them chemically and practically the same tests apply to all. The most important differences in the tests are found in the specific gravities and optical rotation. The U. S. P. directs that the label shall indicate the source of the product and whether synthetic or natural. Methyl Salicylate is found naturally in the oils of gaultheria and betula and in many other plants, but the product found in commerce is usually made by distilling salicylic acid or a salicylate with methyl alcohol and strong sulphuric acid.

Official Description.—A colorless, yellowish or reddish liquid.

Odor, Taste, and Reaction.—Characteristic odor and taste of gaultheria. The alcoholic solution is neutral or slightly acid to moistened litmus paper.

Solubility.—Sparingly soluble in water; miscible with alcohol and glacial acetic acid. It is soluble in 6 volumes of 70 per cent. alcohol at 25° C. (77° F.) with not more than a slight cloudiness.

Specific Gravity.—At 25° C. (77° F.): synthetic, 1.180 to 1.185; when from sweet birch or gaultheria, 1.172 to 1.182.

Tests for Identity and Purity.—It boils between 218° and 221° C. (424.4° and 429.8° F.).

Synthetic Methyl Salicylate, or that from sweet birch, is optically inactive; when obtained from gaultheria, it is slightly lævorotatory, not exceeding −1.5° in a 100-mm. tube at 25° C. (77° F.).

A deep violet color is produced by shaking a drop of Methyl Salicylate with about 5 mils of distilled water and adding a drop of ferric chloride T.S.

Other Volatile Oils or Petroleum Products.—Add 10 mils of potassium hydroxide T.S. to 1 mil of Methyl Salicylate, contained in a capacious test tube, and agitate the mixture. A clear, or slightly cloudy, colorless or faintly yellowish solution results without the separation of any oily drops either on the surface or at the bottom of the liquid.

Heavy Metals.—It does not respond to the Test for heavy metals in volatile oils (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Introduce about 2 mils of Methyl Salicylate into a tared flask, note the exact weight, add 50 mils of half-normal alcoholic potassium hydroxide V.S., connect the flask with a reflux condenser and heat the mixture on a water bath during two hours. Then add a few drops of phenolphthalein T.S. and titrate the excess of alkali with half-normal hydrochloric acid V.S. It shows not less than 98 per cent. of $CH_3C_7H_5O_3$.

Each mil of half-normal alcoholic potassium hydroxide V.S. consumed corresponds to 0.07603 Gm. of $CH_3C_7H_5O_3$. Each gramme of Methyl Salicylate corresponds to not less than 12.9 mils of half-normal alcoholic potassium hydroxide V.S.

U. S. P. Preparations.—Emulsum Olei Morrhuæ; Fluidextractum Cascaræ Sagradæ Aromaticum; Syrupus Sarsaparillæ Compositus.

N. F. Preparations.—Cataplasma Kaolini; Inunctum Mentholis Compositum; Liquor Antisepticus; Liquor Antisepticus Alkalinus; Liquor Ferri Salicylatis; Liquor Pepsini Antisepticus; Nebula Aromatica; Nebula Mentholis Composita; Petroxolinum Methylis Salicylatis; Syrupus Sennæ Compositus; Trochisci Ulmi.

Uses.—Methyl salicylate is used in place of salicylic acid in rheumatism, neuralgia, and kindred diseases. The synthetic product has largely replaced the natural oils, and by many is believed to be identical in its medical properties. As a flavoring agent it is equal in every respect to oil of wintergreen or oil of sweet birch. Care must be taken to select a product conforming to the official tests. Dose, fifteen minims (1 mil).

OLEUM BETULÆ EMPYREUMATICUM RECTIFICATUM. N. F. Rectified Oil of Birch Tar

[Ol. Bet. Empyr. Rect.—Rectified Empyroligneous Oil of Birch Oleum Rusci Rectificatum]

The pyroligneous oil obtained by the dry distillation of the bark and wood of *Betula alba* Linné (Fam. *Betulaceæ*), rectified by steam distillation.

It contains guaiacol, cresol, and pyrocatechol.

Official Description.—A limpid, dark brown liquid.

Odor and Taste.—A penetrating, empyreumatic odor resembling that of Russian leather.

Solubility.—It yields clear solutions with 3 volumes of dehydrated alcohol, and with ether, chloroform, glacial acetic acid, amyl alcohol, oil of turpentine, benzene, or carbon disulphide. When mixed with 3 volumes of alcohol or purified petroleum benzin, the solution is not more than slightly turbid, but a decided turbidity is produced when mixed with the same volume of methyl alcohol.

Specific Gravity.—0.886 to 0.950 at 25° C. (77° F.).

Tests for Identity and Purity.—Warm 2 mils of the Oil with 10 mils of distilled water, agitate and allow the mixture to cool; separate and filter the aqueous liquid. The filtrate is colorless, has a strong, empyreumatic odor and an acid reaction. Add two drops of potassium dichromate T.S. to 4 mils of the same aqueous filtrate; it produces a bright yellow solution which soon becomes darker and turbid. Add one drop of dilute ferric chloride solution (1 in 100) to 4 mils of the filtrate; it produces a green coloration which changes to brown and becomes turbid (distinction from *oil of cade*).

N. F. Preparation.—Unguentum Resorcinolis Compositum.

Uses.—Similar to oil of cade, being used externally in the form of an ointment for eczema and other skin affections.

Official Products from the Zingiberaceæ

CARDAMOMI SEMEN. U. S. Cardamom Seed

[Cardam. Sem.—Cardamomum, U. S. P. VIII Cardamom]

The dried seeds of *Elettaria Cardamomum* White et Maton (Fam. *Zingiberaceæ*), recently removed from the capsules.

Official Description.—Mostly agglutinated in groups of from 2 to 7, the individual seeds, oblong-ovoid in outline, 3- or irregularly 4-sided, convex on the dorsal surface; strongly longitudinally grooved on one side, from 3 to 4 mm. in length; externally reddish-gray-brown, coarsely tuberculated, and with more or less adhering portions of the membranous aril; in section showing a thin reddish-brown seed-coat, a large white perisperm and a central, greenish endosperm enclosing a small straight embryo.

Odor and Taste.—Odor aromatic; taste aromatic, pungent.

Tests for Identity and Purity.—The powder is greenish-brown; consisting chiefly of coarse, angular fragments of cells of the reserve layers and seed-coat; cells of endosperm and perisperm filled with compound starch grains, the individual grains from 0.001 to 0.004 mm. in diameter; fragments of seed with dark brown stone cells, which are polygonal in surface view and about 0.02 mm. in diameter; in mounts made with hydrated chloral T.S. single prisms or crystals in rosette aggregates may separate in the cells of the endosperm and perisperm; fragments of spiral tracheæ with accompanying slightly lignified bast-fibers relatively few.

Cardamom Seed yields not more than 8 per cent. of ash.

U. S. P. Preparations.—Extractum Colocynthidis Compositum; Fluidextractum Aromaticum (from Aromatic Powder); Pulvis Aromaticus; Tinctura Cardamomi; Tinctura Cardamomi Composita; Tinctura Gentianæ Composita; Tinctura Rhei.

N. F. Preparations.—Pulvis Cretæ Aromaticus; Elixir Gentianæ Glycerinatum; Elixir Taraxaci Compositum; Liquor Strychninæ Acetatis; Syrupus Eriodictyi Aromaticus; Tinctura Aromatica; Tinctura Rhei Dulcis; Vinum Rhei Compositum (from Tincture).

Uses.—This valuable aromatic is imported from India. The seeds contain 5 per cent. of an oxygenated volatile oil, of the sp. gr. 0.943, 10 per cent. of fixed oil, starch, mucilage, etc. Owing to the presence of the fixed oil, the seeds are very difficult to powder alone. Hence the practice in preparing compound powders containing cardamom of mixing the other ingredients with it, so that they may absorb the oil. The oil of cardamom is usually made by percolation with ether, and is a mixture of both volatile and fixed oils. It is a flavor, aromatic, stomachic, and carminative. Dose, fifteen grains (1 Gm.).

OLEUM CARDAMOMI. N. F. Oil of Cardamom

[Ol. Cardam.]

A volatile oil distilled from the seeds of *Elettaria Cardamomum* White et Maton (Fam. *Zingiberaceæ*). Preserve it in small, well-stoppered, amber-colored bottles, in a cool place, protected from light.

Official Description.—A colorless or very pale yellow liquid.

Odor and Taste.—Characteristic, aromatic, penetrating and somewhat camphoraceous odor of cardamom, and a persistent, pungent, and strongly aromatic taste.

Solubility.—Soluble in alcohol and readily soluble in four volumes of 70 per cent. alcohol, forming a clear solution.

Specific Gravity.—0.924 to 0.947 at 25° C. (77° F.).

Tests for Identity and Purity.—It is dextrorotatory, the angle of rotation varying from 22° to +44°, in a 100-mm. tube, at 25° C. (77° F.).

N. F. Preparations.—Elixir Cardamomi Compositum (from Compound Spirit); Elixir Vanillini Compositum (from Compound Spirit); Spiritus Cardamomi Compositus; Spiritus Vanillini Compositus.

Uses.—It is used as a flavor and perfume.

ZINGIBER. U. S. Ginger

[Zingib.]

The dried rhizomes of *Zingiber officinale* Roscoe (Fam. *Zingiberaceæ*), the outer cortical layers of which are often either partially or completely removed. Preserve it in tightly closed containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects.

Official Descriptions.—Jamaica Ginger.—Rhizomes free from the outer corky layers, in horizontal, laterally compressed, irregularly branched pieces, from 4 to 16 cm. in length; and from 4 to 20 mm. in thickness; externally light brown, longitudinally striate, ends of the branches with depressed stem-scars; fracture short-fibrous, mealy and resinous; internally yellowish to light brown, cortex thin, endodermis a thin yellow layer enclosing a large central cylinder with numerous groups of fibro-vascular bundles and yellowish oil cells; odor agreeably aromatic; taste aromatic and pungent.

African Ginger.—Rhizomes with cork partly removed on the flattened sides, the patches without cork smooth and of a light brown color, the portions with cork longitudinally or reticulately wrinkled and grayish-brown; fracture short or short-fibrous, internally lemon-yellow or dark bluish with yellowish oil-secretion cells and light yellow to reddish-brown resin cells; odor strongly aromatic; taste intensely pungent.

Calcutta Ginger.—Rhizomes resembling the African Ginger, the branches or "fingers" being somewhat larger, and with a considerable proportion of shriveled pieces, externally grayish-brown or grayish-blue; fracture short and mealy, or horny; internally light yellow or light brownish-yellow with numerous yellowish oil cells and yellowish brown resin cells; odor aromatic; taste starchy and strongly pungent.

Calicut Ginger.—Rhizomes resembling African Ginger, more of the periderm being usually removed; externally more or less uniformly light brown; fracture short or short-fibrous, and mealy; internally light yellow or brownish-yellow with numerous yellowish oil and resin cells; odor aromatic; taste very pungent.

Cochin Ginger.—Rhizomes with most of the corky layer removed on the flattened sides; externally light brown to grayish-yellow, fracture short and mealy; internally yellowish-white with numerous yellowish oil cells and brownish-red or blackish resin cells; odor aromatic; taste pungent but not so persistent as in the African variety.

Japanese Ginger.—Rhizome somewhat resembling Cochin Ginger but usually with a thin coating of lime; externally nearly smooth or slightly wrinkled and of a whitish color; fracture short and very mealy; internally varying from a yellowish-white to light brown and with numerous brownish-red resin cells; odor aromatic; taste pungent.

Tests for Identity and Purity.—Powdered Ginger is light yellow, or light brown to dark brown; under the microscope it exhibits numerous starch grains varying greatly in form and size in the different varieties, being nearly spherical, ovoid, ellipsoidal or pear-shaped and frequently with a characteristic beak, usually from 0.005 to 0.04 mm., occasionally from 0.045 to 0.06 mm. in the long diameter; sclerenchymatous fibers long, thin-walled, non-lignified, with oblique pores and distinctly undulate on one side; oil-secretion cells with suberized walls and containing a light yellowish or yellowish-brown, oily substance; cork cells absent in the Jamaica variety.

Introduce 4 Gm. of ground Ginger into a 200-mil flask, fill to the mark with distilled water, and agitate at half-hour intervals during eight hours. Then allow the mixture to stand for sixteen hours, and filter. Evaporate 50 mils of the filtrate, representing 1 Gm. of the drug, on a water bath, dry to constant weight at 100° C. (212°F.), and weigh; it yields not less than 8 per cent. of residue.

Ginger yields not less than 2 per cent. of a non-volatile extract soluble in ether and not less than 4 per cent. of an extract soluble in alcohol.

Ginger yields not more than 8 per cent. of ash.

U. S. P. Preparations.—Fluidextractum Aromaticum (from Aromatic Powder); Fluidextractum Zingiberis; Oleoresina Zingiberis; Pulvis Aromaticus; Pulvis Rhei Compositus; Syrupus Zingiberis (from Fluidextract); Tinctura Zingiberis.

N. F. Preparations.—Elixir Rubi Compositum; Pulvis Aromaticus Rubifaciens; Pulvis Myrciæ Compositus; Tinctura Antiperiodica; Tinctura Antiperiodica sine Aloe; Tinctura Aromatica.

Uses.—This well-known and largely used rhizome owes its virtues to about 4 per cent. of volatile oil, having the composition $C_{10}H_{16}$, and therefore a terpene, and a soft, pungent, aromatic resin, which is soluble in alcohol and ether. Ginger is used as a stimulant and carminative in does of fifteen grains (1 Gm.).

ZEDOARIA. N. F. Zedoary

[Zedoar.]

The dried rhizome of *Curcuma Zedoaria* (Bergius) Roscoe (Fam. *Zingiberaceæ*).

Official Description.—Usually cut into transverse rounded sections, twisted and wrinkled, from 1 to 4 cm. in diameter, and from 5 to 10 mm. in thickness; externally grayish-brown, hairy, rough, with a few root scars; transverse surface pale reddish to gray-brown; a distinct, dark circular endodermis, which is from 2 to 5 mm. in width, separates the cortex; the stele contains numerous, orange-colored resin cells and irregularly distributed, lighter colored wood bundles which are fewer in the cortex; fracture short, somewhat mealy and waxy.

Odor and Taste.—Odor aromatic, camphor-like; taste aromatic, warm, slightly bitter.

Tests for Identity and Purity.—Under the microscope, sections show a thick cork, a thin epidermis with numerous characteristic hairs, thick-walled, one- to six-celled, up to 1 mm. in length and often thicker in the middle than at the base; the parenchyma of the cortex and of the central cylinder rich in starch; secretion cells isodiametric with suberized walls, contents colorless or yellowish; the endodermis of small, thin-walled quadratic cells, the fibro-vascular bundles collateral, more numerous in the central cylinder and nearer the endodermis; few bast-fibers in the cortex and no crystal cells.

The powder contains numerous starch-grains which are ovoid, from 0.02 to 0.07 mm. in length and from 0.007 to 0.03 mm. in thickness, having the point of origin of growth in the smaller end of the grain; numerous characteristic, thick-walled hairs; rich in parenchyma; very few bast-fibers; no calcium oxalate crystals or stone cells.

Zedoary yields not more than 7 per cent. of ash.

N. F. Preparations.—Pilulæ Antiperiodicæ; Pilulæ Antiperiodicæ sine Aloe; Tinctura Amara; Tinctura Antiperiodica; Tinctura Antiperiodica sine Aloe; Tinctura Zedoariæ Amara.

Uses.—It is a stimulating aromatic in colic and digestive debility. The dose is fifteen grains (1 Gm.).

Official Product from the Aristolochiaceæ

ASARUM. N. F. Asarum

[**Asar.** CANADA SNAKE-ROOT WILD GINGER]

The dried rhizome and roots of *Asarum canadense* Linné (Fam. *Aristolochiaceæ*), with only an occasional leaf or flower present, and without the presence of more than 5 per cent. of other foreign matter. Its chief constituent is a volatile oil largely used in perfumery.

Official Description.—Of horizontal growth, occasionally branched, two-edged when young, quadrangular when older, finely striate, usually more or less twisted, from 5 to 17 cm. in length and from 2 to 4 mm. in thickness; nodes enlarged with irregular scars from petioles and remains of pedicels; internodes with annular scars from scales; dark purplish-brown externally; fracture short, internally whitish, starchy or resinous; attached roots few, from 5 to 7 cm. in length and not over 1 mm. in thickness, having from four to six radial fibro-vascular bundles.

Odor and Taste.—Odor aromatic, non-irritating upon heating; taste pungent and slightly bitter.

Tests for Identity and Purity.—In transverse section the rhizome shows a thick bark with numerous oil cells, a wood with about twelve fibro-vascular bundles and a large pith.

Examined microscopically, the powdered drug shows simple and two- to four-compound starch grains, the individual grains being from 0.004 to 0.02 mm. in diameter, and tracheæ with scalariform or reticulate thickenings, a few spiral.

Asarum yields not more than 12 per cent. of ash.

N. F. Preparation.—Syrupus Asari Compositus.

Uses.—A feeble aromatic, dose thirty grains (2 Gm.).

Unofficial Terpenes

Oil of Burgundy Pitch	From *Abies excelsa*. Fam. Coniferæ. Habitat, Europe
Calamus	From the rhizome of *Acorus calamus*. Fam. Araceæ. Habitat, North America. The yield is about 1½ to 2 per cent.
Canada Turpentine	From the oleoresin of *Abies balsamea*. Fam. Coniferæ
Cedrat	From *Citrus medica*. Fam. Rutaceæ. Used in perfumery
Elemi	From *Canarium commune*. Fam. Burseraceæ. Habitat, Philippine Islands. The yield is about 10 per cent.
Gurjun Balsam	From *Dipterocarpus turbinatus*. Fam. Dipterocarpaceæ. Habitat, India. The yield is from 40 to 70 per cent.
Hemlock Spruce	From *Abies canadensis*. Fam. Pinaceæ. Habitat, Canada
Hungarian Turpentine	From *Pinus pumilio*. Fam. Pinaceæ
Jaborandi	From the leaflets of *Pilocarpus pennatifolius*. Fam. Rutaceæ. Habitat, Brazil

Unofficial Terpenes—*Continued*

Oil of Myrtle	From *Myrtus communis*. Fam. Myrtaceæ
Sage	From the leaves of *Salvia officinalis*. Fam. Labiatæ. The yield is about ¼ per cent.
Strassburg Turpentine	From *Abies pectinata*. Fam. Pinaceæ
Templin	From the shoots of *Pinus pumilio*. It is a colorless or yellowish-green oil, of an agreeable, somewhat terebinthinate odor

Unofficial Oxygenated Oils

Oil of Absinthium	From *Artemisia absinthium*. Fam. Compositæ
Angustura	From the bark of *Galipea cusparia*. Fam. Rutaceæ. Habitat, South America. Yield about ⅙ per cent. Composition, $C_{13}H_{24}O$
Anthemis	From the flower heads of *Anthemis nobilis*. Fam. Compositæ. Habitat, Europe
Arnica	From the root and flowers of *Arnica montana*. Fam. Compositæ. Habitat, Europe. Yield ½ to 1 per cent.
Asarum	From the rhizome of *Asarum canadense*. It is used to give permanence to the odors of some cologne waters
Buchu	From the leaves of *Barosma betulina*, *B. crenulata*, and *B. serratifolia*. Fam. Rutaceæ. Habitat, Southern Africa. The yield is from ½ to 1½ per cent.
Camphor	From the preparation of crude camphor. Fam. Laurineæ. Habitat, Asia
Oil of Canella	From the bark of *Canella alba*. Fam. Canellaceæ. Habitat, Southern United States. The yield is from ½ to 1 per cent.
Capsicum	From the fruit of *Capsicum fastigiatum*. Fam. Solanaceæ. Habitat, Southern and Central America. The yield is very small
Carrot	From the fruit of *Daucus carota*. Fam. Umbelliferæ. Indigenous to Northern Asia. The yield is very small
Cascarilla	From the bark of *Croton eluteria*. Fam. Euphorbiaceæ. Indigenous to the Bahama Islands. The yield of oil is about 1½ per cent.
Catnep	From the leaves and tops of *Nepeta cataria*. Fam. Labiatæ. Habitat, Europe. The yield is small
Celery	From the fruit of *Apium graveolens*. Fam. Umbelliferæ. Habitat, Europe
Citronella	From the leaves of *Andropogon nardus*. Habitat, Ceylon. Contains a terpene, citronellol, and a heptoic aldehyde. Used in perfumery
Clove Cinnamon	From *Persea caryophyllata*
Curcuma	From the rhizome of *Curcuma longa*. Fam. Zingiberaceæ. Habitat, India. The yield is about 1 per cent.
Cyna	From the flowers of *Artemisia maritima*. Fam. Compositæ. Habitat, Asia. A pale yellow oil. The yield is about 2 per cent.
Dahlia	From the tubers of *Dahlia pinnata*
Elder (European)	From the flowers of *Sambucus nigra*. Fam. Caprifoliaceæ. Habitat, Europe. The yield is from ⅓ to ½ per cent.
Feverfew	From *Pyrethrum parthenium*. Fam. Compositæ. Habitat, Europe
Galangal	From the rhizome of *Alpinia officinarum*. Fam. Zingiberaceæ. Habitat, China. The yield of oil is about ½ per cent.
Ginger	From the rhizome of *Zingiber officinale*. Fam. Zingiberaceæ. Habitat, Jamaica. The yield is from 1 to 2 per cent.
Ginger Grass	From the flowers of *Andropogon Schœnanthus*
Golden Rod	From the leaves of *Solidago odora*
Hedeoma Oil of Pennyroyal, U. S. P. VIII	A volatile oil distilled from the leaves and flowering tops of Hedeoma, the dried leaves and flowering tops of *Hedeoma pulegioides* (Linné) Persoon (Fam. Labiatæ). A pale yellow, limpid liquid of characteristic, pungent, mint-like odor and taste. Specific gravity 0.920 to 0.935 at 25° C. (77° F.). It forms a clear solution with 2 volumes or more of 70 per cent. alcohol. Dextrogyrate, the angle of rotation varying from about +18° to +22° in a 100-mm. tube, at a temperature of 25° C. (77° F.). This is an oxygenated oil, and is used principally to protect the exposed parts of the body from the bites of flies, mosquitoes, fleas, etc. It is employed sometimes in amenorrhœa, in doses of one to three minims (0.05 to 0.2 mil). The drug was official in the U. S. P. IX and is a stimulant and aromatic. Dose, two drachms (8 Gm.)
Heliotrope	From the flowers of *Heliotropium peruvianum* and *H. grandiflorum*
Hop	From the strobiles of *Humulus lupulus*. Fam. Urticaceæ. Habitat, North America. The yield is about 0.8 per cent.
Horsemint	From the leaves and flowers of *Monarda punctata*. Fam. Labiatæ. Habitat, United States
Hyssop	From the herb of *Hyssopus officinalis*. Fam. Labiatæ. Habitat, Southern Europe. The yield is from ¼ to ½ per cent.
Ihlang-Ihlang	From *Unona odoratissima*
Indian Cannabis	From *Cannabis sativa*. Fam. Moraceæ. Habitat, Asia
Inula	From the root of *Inula helenium*. Fam. Compositæ. Habitat, Europe. The yield is very small
Jessamine	From the flowers of *Jasminum grandiflorum* and *J. fragrans*. Fam. Jasmineæ. The yield is very small. Used in perfumery
Laurel	From *Laurus nobilis*. Fam. Lauraceæ. Habitat, Southern Europe. The yield of oil is about 20 per cent.
Lilac	From the flowers of *Syringa vulgaris*. Fam. Oleaceæ. Used in perfumery
Lily of the Valley	From the flowers of *Convallaria majalis*. Fam. Liliaceæ. The yield is very small. Used in perfumery

Unofficial Oxygenated Oils—*Continued*

Oil of Linden	From the inflorescence of different species of *Tilia*. Fam. Tiliaceæ. Habitat, Europe and America. The yield is from 1/20 to 1/10 per cent.
Lovage	From the root of *Levisticum officinale*. Fam. Umbelliferæ. Habitat, Europe
Marrubium	From *Marrubium vulgare*. Fam. Labiatæ. Habitat, Europe and Asia. The yield is small
Marsh Tea	From the leaves of *Ledum palustre*. Fam. Ericaceæ. Habitat, Europe and Asia. The yield is variable, but from ¾ to 1½ per cent.
Masterwort	From *Heracleum lanatum*. Fam. Umbelliferæ. Habitat, United States. The yield is small
Matico	From the leaves of *Piper angustifolium*. Fam. Piperaceæ. Habitat, tropical America. The yield is about 1½ per cent.
Matricaria	From the flowers of *Matricaria chamomilla*. Fam. Compositæ. Habitat, Europe and United States. The yield is about ¼ per cent.
Melissa	From the leaves and tops of *Melissa officinalis*. Fam. Labiatæ. Habitat, Europe and United States. The yield is from ⅛ to ¼ per cent.
Mignonette	From the flowers of *Reseda odorata*. Fam. Resedaceæ. Habitat, Southern France. The yield is very small. Used in perfumery
Mountain Balm	From the leaves of *Eriodictyon californicum*. Fam. Hydrophyllaceæ. Habitat, California
Myrrh	From the gum-resin of *Commiphora myrrha*. Fam. Burseraceæ. Habitat, Arabia. The yield is from 2 to 2½ per cent.
Olibanum	From *Boswellia Carterii*. Fam. Burseraceæ. Habitat, Arabia. The yield is from 4 to 8 per cent.
Parsley	From the fruit of *Petroselinum sativum*. Fam. Umbelliferæ. Habitat Southern Europe. The yield is about 1½ per cent.
Patchouly	From *Pogostemon Patchouly*. Fam. Labiatæ. Habitat, East India
Phellandrium	From the fruit of *Œnanthe phellandrium*. Fam. Umbelliferæ. The yield is about 1½ per cent.
Red Cedar	From *Juniperus virginiana*. Fam. Pinaceæ. Habitat, Canada and United States
Rhodium	From the root of *Convolvulus Scoparius*. Habitat, Canary Islands. The *oil of rhodium* sold in pharmacy is usually a factitious article, made by mixing 1 part of oil of rose with 20 parts of oil of copaiba. It is used as a lure for rats
Saffron	From *Crocus sativus*. Fam. Irideæ. Habitat, Europe. The yield is about 1 per cent.
Serpentaria	From the rhizome and roots of *Aristolochia Serpentaria* and *A. reticulata*. Fam. Aristolochiaceæ. Habitat, Virginia. The yield is about ½ per cent.
Summer Savory	From the herb of *Satureja hortensis*. Fam. Labiatæ
Sweet Basil	From *Ocymum basilicum*. Fam. Labiatæ. Habitat, Asia and Africa
Sweet Cicely	From *Osmorhiza longistylis*. Fam. Umbelliferæ
Sweet Marjoram	From *Origanum marjorana*. Fam. Labiatæ
Sweet Violet	From the flowers of *Viola odorata*. Fam. Violaceæ
Tansy	From the leaves of *Tanacetum vulgare*. Fam. Compositæ. Habitat, Europe and North America. The yield is variable, from ¼ to ½ per cent.
Tea	From the leaves of *Thea sinensis*. Fam. Ternstræmiaceæ. Habitat, China. The yield is from ½ to 1 per cent.
Thuja	From the branches of *Thuja occidentalis*. Fam. Coniferæ. Habitat, Canada and United States. The yield is variable, but about 1 per cent.
Tuberose	From the flowers of *Polianthes tuberosa*. Fam. Amaryllidaceæ
Verbena (Lemongrass)	From *Andropogon citratis*. A grass cultivated in Ceylon and Singapore
Wormwood	From the herb of *Artemisia absinthium*. Fam. Compositæ. Habitat, Europe. The yield is about ½ per cent.
Zedoary	From the rhizome of *Curcuma Zedoaria*. Fam. Zingiberaceæ. Habitat, East India Islands

Stearoptenes from Volatile Oils

CAMPHORA. U. S. Camphor
[Camph.]

A ketone [$C_{10}H_{16}O$ or $C_9H_{16}CO = 152.13$] obtained from *Cinnamomum Camphora* (Linné) Nees et Ebermaier (Fam. *Lauraceæ*); it is dextrorotatory. Preserve it in well-closed containers, in a cool place.

Preparation.—Refined camphor is usually made by subliming in circular cakes the crude granular camphor imported from China and Japan. The vessels in which the camphor is sublimed are of cast iron, circular, from twelve to fifteen inches or more in diameter, and four inches deep, with perpendicular sides, and a ledge at top, on which the cover rests. This consists of sheet iron, with a hole through the centre about an inch in diameter, over which a small hollow cone of sheet iron is placed loosely. The crude camphor, mixed with lime—the object of which is said to be to combine with the moisture present which would interfere with the due solidification of the camphor vapor—is placed in the iron vessels described, of which from twenty to fifty are arranged in a long sand bath. Heat is then applied until the camphor melts, after which the heat is kept as nearly uniform as possible, so that the vaporization may take place regularly, without violent ebullition. The camphor sublimes on the lower surface of the lid in a solid circular cake, care being taken, by the occasional removal of the iron cone and clearing of the opening by means of a knife, to allow the escape of any excess of the vapor; the round hole in the cakes is thus accounted for. Camphor is sometimes sublimed in powder by conducting the vapor into a large chamber (see Sublimation, page 181). This powder is often compressed into oblong cakes, forming *compressed camphor*. Japanese camphor, refined in Formosa, and put up in ounce cakes and pound packages is now supplied. Camphor is now made synthetically under the Thurlow patent by the interaction of oil of turpentine and anhydrous oxalic acid, the resulting mixture being treated with lime, and then distilled. This product is optically inactive and is therefore not recognized by the U. S. P. IX.

When camphor is triturated, in about molecular proportions, with menthol, thymol, phenol or hydrated chloral, liquefaction ensues.

Official Description.—It occurs in white, translucent masses or granules of a tough consistence. It is readily pulverizable in the presence of a little alcohol, ether or chloroform.

Odor and Taste.—It has a penetrating, characteristic odor, and a pungent, aromatic taste.

Solubility.—Slightly soluble in water and freely soluble in alcohol, chloroform, ether, carbon disulphide, petroleum benzin, or in fixed or volatile oils.

Specific Gravity.—About 0.990 at 25° C. (77° F.).

Tests for Identity and Purity.—Camphor melts between 174° and 177° C. (345.2° and 350.6° F.).

The specific rotation $[\alpha]_D$ of Camphor, in a solution in alcohol at 25° C. (77° F.). between +41° and +42° in a 200-mm. tube, containing 10 Gm. of Camphor in each 100 mils of solution. The alcohol must be of the strength of about 95 per cent. by volume.

It volatilizes at ordinary temperatures. On gradually heating about 2 Gm. of Camphor, it sublimes without carbonization and without leaving more than 0.05 per cent. of ash.

Moisture.—A solution of Camphor in petroleum benzin (1 in 10) is clear.

Chlorinated Products.—Hold the looped end of a piece of clean copper wire in a non-luminous flame until it glows, without coloring the flame green, then dip the loop into Camphor, ignite the adhering Camphor, and hold it so that the liquid burns outside of a non-luminous flame. On slowly bringing the flame from the burning Camphor on the loop in contact with the lower outer edge of the non-luminous flame, no green tinge is discernible.

U. S. P. Preparations.—Aqua Camphoræ; Collodium Flexile; Linimentum Belladonnæ; Linimentum Camphoræ; Linimentum Chloroformi (from Soap Liniment); Linimentum Saponis; Spiritus Camphoræ; Tinctura Opii Camphorata.

N. F. Preparations.—Ceratum Camphoræ (from Liniment); Ceratum Plumbi Subacetatis; Chloral Camphoratum; Emplastrum Fuscum Camphoratum; Linimentum Ammonii Iodidi; Linimentum Opii Compositum; Linimentum Saponato-Camphoratum; Linimentum Sinapis Compositum; Lotio Ammoniacalis Camphorata (from Spirit of Camphor); Menthol Camphoratum; Mistura Camphoræ Acida (from Water); Mistura Camphoræ Aromatica (from Water); Mistura Opii et Chloroformi Composita (from Spirit); Mistura Opii et Rhei Composita (from Spirit); Nebula Aromatica; Nebula Mentholis Composita; Petroxolinum Chloroformi Camphoratum; Petroxolinum Phenolis Camphoratum; Pilulæ Antiperiodicæ; Pilulæ Antiperiodicæ sine Aloe; Pilulæ Opii et Camphoræ; Tinctura Antiperiodica; Tinctura Antiperiodicæ sine Aloe; Tinctura Kino et Opii Composita (from Spirit); Tinctura Pectoralis (from Spirit); Unguentum Camphoræ.

Camphoric Acid, $C_8H_{14}(COOH)_2$, which was official in the U. S. P. VIII, is an oxidation product of camphor, obtained by treating camphor with hot nitric acid. It is used in the treatment of bronchitis and phthisis in doses of fifteen grains (1 Gm.).

Uses.—Camphor is a stimulant. It is used in liniments, given in doses of two to ten grains (0.125 to 0.6 Gm.) by the mouth, and in one-half to two grains (0.032–0.13 Gm.) hypodermically. When it is required as a diffusible stimulant in threatened collapse, it is injected hypodermically and a sterile 10 per cent solution in olive oil is used. There are numerous official preparations, the list being given above.

CAMPHORA MONOBROMATA. U. S. Monobromated Camphor [Camph. Monobrom.]

Ortho-monobromcamphor [$C_{10}H_{15}OBr$ or $C_9H_{15}Br.CO = 231.04$]. Preserve it in well-closed containers, protected from light.

Preparation.—This compound of camphor may be made by Prof. Maisch's process as follows: Four ounces of bromine are introduced gradually into a retort in which thirteen ounces of camphor have been previously placed. In fifteen or twenty minutes a brisk reaction will commence. When this subsides, eight or nine ounces more of bromine are to be poured in, in four portions, waiting after each addition until the reaction ceases. The liquid in the retort is now to be heated to about 132° C. (270° F.), then cooled, and sufficient petroleum benzin added to dissolve the crystalline mass. The crystals which are formed on cooling may be purified by recrystallization from petroleum benzin or hot alcohol.

Official Description.—It occurs in colorless, prismatic needles or scales, or as a powder.

Odor and Taste.—It has a mild but characteristic, camphoraceous odor and taste. Permanent in the air. It is decomposed by prolonged exposure to the sunlight.

Solubility.—One Gm. of Monobromated Camphor dissolves in 6.5 mils of alcohol, 0.5 mil of chloroform, and in 1.6 mils of ether at 25° C. (77° F.); almost insoluble in water.

Tests for Identity and Purity.—It melts between 74° and 76° C. (165.2° to 168.8° F.).

Heat a mixture of about 0.1 Gm. each of Monobromated Camphor and silver nitrate and 2 mils each of nitric acid and sulphuric acid until nitrous vapors are no longer evolved; a yellowish precipitate of silver bromide is obtained.

Incinerate about 2 Gm. of Monobromated Camphor; not more than 0.05 per cent. of ash remains.

Soluble Bromide.—Shake about 0.5 Gm. of powdered Monobromated Camphor with 10 mils of distilled water and filter. The filtrate is neutral to litmus and is not rendered more than slightly opalescent by the addition of a few drops of silver nitrate T.S.

Uses.—Monobromated camphor is given as a nerve sedative. in doses of two to five grains (0.125 to 0.3 Gm.).

Official Substances Containing Nitrogenated and Sulphurated Oils with Allied Products

OLEUM AMYGDALÆ AMARÆ. U. S. Oil of Bitter Almond [Ol. Amygd. Amar.—Bitter Almond Oil]

A volatile oil obtained by maceration and distillation from the ripe kernels of *Prunus Amygdalus amara* DeCandolle (Fam. *Rosaceæ*), and from other kernels containing amygdalin. It yields not less than 85 per cent. of benzaldehyde [C_7H_6O] and not less than 2 per cent. nor more than 4 per cent of hydrocyanic acid [HCN] The botanical source from which it is derived must be stated on the label. Preserve it in small, well-stoppered, completely filled, amber-colored bottles protected from light and air. Oil showing crystals of benzoic acid must not be dispensed.

Note.—This Oil is intended for medicinal use; it must not be used for flavoring foods.

Preparation.—As stated above, oil of bitter almond is produced as the result of the reaction of emulsin on amygdalin in aqueous mixture; it therefore does not pre-exist in the almond, and cannot be obtained from sweet almond, because amgydalin is not present in the latter, but it is now permitted to be made from other kernels containing amygdalin, such as peach and apricot kernels, although the source must be stated upon the label.

$$\underset{\text{Amygdalin}}{C_{20}H_{27}NO_{11}} + \underset{\text{Water}}{2H_2O} = \underset{\text{Benzaldehyde}}{C_7H_6O} + \underset{\text{Glucose}}{2C_6H_{12}O_6} + \underset{\text{Hydrocyanic Acid}}{HCN}$$

The process is simply to make a mixture of the bitter almond cake (obtained after the fixed oil has been extracted) with water, and distil it by passing a current of steam through it. The proportions of benzaldehyde and hydrocyanic acid in the oil are recognized as valuable tests (see official assay below, also Benzaldehydum).

Official Description.—A clear, colorless or yellow, strongly refractive liquid.

Odor and Taste.—Characteristic odor and taste of benzaldehyde.

Solubility.—Slightly soluble in water and soluble in all proportions in alcohol or ether. It dissolves, forming a clear solution, in 2 volumes of 70 per cent. alcohol.

Specific Gravity.—1.038 to 1.060 at 25° C. (77° F.).

Tests for Identity and Purity.—Refractive index: 1.5428 to 1.5439 at 20° C. (68° F.) (see U. S. P., Test No. 22, Chapter LXII).

It is optically inactive or dextrorotatory, not exceeding +0° 10′ in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

When first prepared, the Oil is neutral to litmus paper, but afterwards develops an acid reaction due to the formation of benzoic acid.

Heavy Metals.—It does not respond to the Test for heavy metals in volatile oils (see U. S. P., Test No. 3, Chapter LXII).

Chlorinated Products.—Hold the looped end of a piece of clean copper wire in a non-luminous flame until it glows without coloring the flame green, cool the wire, dip the loop into Oil of Bitter Almond, ignite the latter and hold it so that the liquid burns outside of the non-luminous flame. On slowly bringing the flame from the burning Oil of Bitter Almond on the loop in contact with the lower outer edge of the non-luminous flame, no green tinge is discernible.

Nitrobenzene.—Add 10 drops of the Oil to a little alcohol, then add a small amount of zinc dust and 2 mils of acetic acid and boil the mixture for a short time; no odor of phenylisocyanide develops after rendering it strongly alkaline with potassium hydroxide T.S., adding a few drops of chloroform and heating.

Assay for Benzaldehyde.—Dissolve about 3 mils of freshly redistilled phenylhydrazine in 60 mils of alcohol and titrate 25 mils of this solution, which must always be freshly prepared, with half-normal hydrochloric acid V.S., using methyl orange T.S. as indicator. To about 1 Gm. of the Oil of Bitter Almond, accurately weighed, add 25 mils of the phenylhydrazine solution just prepared and allow it to stand for thirty minutes. Add a drop of methyl orange T.S., and acidify the mixture by adding a measured excess of half-normal hydrochloric acid V.S. Filter the mixture and wash the precipitate with small portions of distilled water until the washings cease to redden blue litmus paper. Then titrate the excess of hydrochloric acid in the filtrate with half-normal potassium hydroxide V.S. and subtract the number of mils of the half-normal hydrochloric acid V.S. consumed from the number of mils of the half-normal hydrochloric acid V.S. used in titrating the 25 mils of phenylhydrazine solution; the difference multiplied by 0.053 gives the weight of benzaldehyde.

Assay for Hydrocyanic Acid.—Dissolve 15 Gm. of crystallized magnesium sulphate in enough distilled water to measure 100 mils, add 5 mils of this solution to 40 mils of distilled water, then add 5 mils of half-normal sodium hydroxide V.S. and two drops of potassium chromate T.S., and titrate the solution with tenth-normal silver nitrate V.S. to the production of a permanent reddish tint. Pour this mixture into a 100-mil flask containing about 1 Gm. of Oil of Bitter Almond, accurately weighed, mix well and titrate again with tenth-normal silver nitrate V.S. until a red tint, which does not disappear on shaking, is reproduced. Conduct this titration as rapidly as possible. One mil of tenth-normal silver nitrate V.S. corresponds to 0.0027 Gm. of hydrocyanic acid. One gramme of the Oil corresponds to not less than 7.4 mils nor more than 14.8 mils of tenth-normal silver nitrate V.S.

U. S. P. Preparations.—Aqua Amygdalæ Amaræ; Spiritus Amygdalæ Amaræ.
N. F. Preparations.—Elixir Amygdalæ Compositum; Elixir Anisi (from Spirit).

Uses.—Oil of bitter almond is sedative and poisonous if it contains hydrocyanic acid. The dose is from one-half to one minim (0.03 to 0.05 mil). It must not be used for flavoring foods, but should always be replaced by benzaldehyde, which does not involve the danger from hydrocyanic acid poisoning.

BENZALDEHYDUM. U. S. Benzaldehyde

[Benzaldehyd.]

An aldehyde produced synthetically or obtained from oil of bitter almond and containing not less than 85 per cent. of C_7H_6O or $C_6H_5.CHO$ (106.05). Preserve it in small, well-stoppered bottles, protected from light.

Preparation.—Artificial benzaldehyde, which is identical with the product obtained from the almond, is now made from toluene, C_7H_8. By the action of chlorine upon the hot toluene, there is produced benzyl chloride, $C_6H_5CH_2Cl$, and benzal chloride, $C_6H_5CHCl_2$, and these yield benzaldehyde upon treatment with manganese dioxide or other oxidizing agents. Artificial benzaldehyde is free from hydrocyanic acid, but is liable to retain traces of chlorine compounds. This product must not be confounded with nitrobenzene (nitrobenzol), or *oil of myrbane*, which is made by reacting on benzene with nitric acid. Nitrobenzene is made in large quantities for perfuming soap. Its odor is similar to, but by no means identical with that of oil of bitter almond.

Official Description.—A colorless, or yellowish, strongly refractive liquid.

Odor and Taste.—A bitter-almond-like odor, and a burning aromatic taste.

Solubility.—Slightly soluble in water, miscible with alcohol, ether, or fixed or volatile oils.

Specific Gravity.—About 1.045 at 25° C. (77° F.).

Tests for Identity and Purity.—*Hydrocyanic Acid.*—Shake 10 drops of Benzaldehyde with 5 mils of distilled water, add 0.5 mil of potassium hydroxide T.S. and 0.1 mil of ferrous sulphate T.S., and warm the mixture gently. Now add a slight excess of hydrochloric acid to the mixture; no greenish-blue color nor blue precipitate is produced within fifteen minutes.

Chlorinated Products.—Hold the looped end of a piece of clean copper wire in a non-luminous flame until it glows, without coloring the flame green, cool the wire, dip the loop into Benzaldehyde, ignite the latter and hold it so that the liquid burns outside of the non-luminous flame. On slowly bringing the flame from the burning Benzaldehyde on the loop in contact with the lower outer edge of the non-luminous flame, no green tinge is discernible.

Nitro-benzene.—Dissolve 1 mil of Benzaldehyde in 20 mils of alcohol, add distilled water until a slight turbidity is produced, and maintain a brisk evolution of hydrogen for one hour by the addition of zinc and diluted sulphuric acid. Filter and evaporate the liquid to about 20 mils and boil 10 mils of the evaporated liquid with 1 drop of potassium dichromate T.S.; no violet color is produced.

Assay.—Dissolve about 3 mils of freshly redistilled phenylhydrazine in 60 mils of alcohol and titrate 25 mils of the solution, which must always be freshly prepared, with half-normal hydrochloric acid V.S., using methyl orange T.S. as indicator. To about 1 Gm. of the Benzaldehyde, accurately weighed, add 25 mils of the phenylhydrazine solution just prepared and allow it to stand for thirty minutes. Add a drop of methyl orange T.S., and acidify the mixture by adding a measured excess of half-normal hydrochloric acid V.S. Filter the mixture and wash the precipitate with small portions of distilled water until the washings cease to redden blue litmus paper. Then titrate the excess of hydrochloric acid in the filtrate with half-normal potassium hydroxide V.S. Subtract the number of mils of half-normal hydrochloric acid V. S. consumed from the number of mils of half-normal hydrochloric acid V. S., used in titrating the 25 mils of phenylhydrazine solution; the difference multiplied by 0.053, gives the weight of the Benzaldehyde present.

Uses.—Benzaldehyde is largely used now in place of oil of bitter almond for flavoring purposes as it is much safer when pure, on account of the absence of hydrocyanic acid.

PRUNUS VIRGINIANA. U. S. Wild Cherry

[**Prun. Virg.**—Wild Black Cherry Bark]

The stem-bark of *Prunus serotina* Ehrhart (*Prunus virginiana* Miller) (Fam. *Rosaceæ*), collected in autumn and carefully dried. Preserve Wild Cherry in tightly-closed containers, protected from light.

Official Description.—Usually in transversely curved pieces fron 2.5 to 8 cm. in length and from 0.5 to 4 mm. in thickness; outer surfaces light brown or greenish-brown, smooth, except for numerous lenticels from 3 to 4 mm. in length; inner surfaces light brown, longitudinally striate and occasionally fissured; fracture short, granular.

Odor and Taste.—Odor distinct, bitter almond-like when macerated in water; taste astringent, aromatic, and agreeably bitter.

Tests for Identity and Purity.—Under the microscope, sections of Wild Cherry show a tendency for the separation in radial segments or bands of the phloem tissues from the rather broad medullary rays; periderm usually of a few layers of cells; outer bark from young twigs with 1 or 2 nearly continuous layers of cells, the latter being of very irregular shape, often branching and with thick lamellated, porous walls; medullary rays extending in more or less scythe-shaped groups from the cambium to the outer bark, from 1 to 10 cells in width, some of the cells occasionally being modified to stone cells; between the medullary rays occur numerous small groups of stone cells, resembling those of the outer bark and occasionally modified to sclerenchymatous fibers; calcium oxalate mostly in crystal fibers consisting of monoclinic prisms, from 0.015 to 0.04 mm. in diameter, also in rosette aggregates from 0.01 to 0.04 mm. in diameter; starch grains numerous, occurring in the medullary rays and parenchyma.

The powder is light brown; when examined under the microscope it exhibits bast-fibers and stone cells with thick, strongly lignified walls; crystal fibers with monoclinic prisms and rosette aggregates of calcium oxalate, from 0.01 to 0.04 mm. in diameter; starch grains nearly spherical, from 0.003 to 0.004 mm. in diameter.

U. S. P. Preparation.—Syrupus Pruni Virginianæ.

N. F. Preparations.—Elixir Taraxaci Compositum (from Fluidextract); Emulsum Olei Morrhuæ cum Pruno Virginiana (from Fluidextract); Fluidextractum Pruni Virginianæ; Infusum Pruni Virginianæ; Syrupus Cimicifugæ Compositus; Syrupus Pini Strobi Compositus; Syrupus Pini Strobi Compositus cum Morphina; Vinum Pruni Virginianæ; Vinum Pruni Virginianæ Ferratum (from Wine).

Uses.—This bark contains amygdalin, emulsin, tannin, bitter principle, starch, resin, etc. As with bitter almond, contact with water results in the production of oil of bitter almond, and hydrocyanic acid; as both of the latter principles are volatile and active, all the preparations of wild cherry should be made without heat. An insoluble precipitate of altered tannin is often noticed in old fluidextract of wild cherry Wild cherry bark is sedative and tonic. Dose, thirty grains (2 Gm.)

ACIDUM HYDROCYANICUM DILUTUM. U. S. Diluted Hydrocyanic Acid

[Acid. Hydrocyan. Dil.—Diluted Prussic Acid Acidum hydrocyanicum dilutum P. I.]

An aqueous solution containing not less than 1.9 per cent. nor more than 2.1 per cent. of HCN (27 02) and not more than 0.1 per cent. of HCl. Preserve it in small, dark amber-colored, well-stoppered vials.

Preparation.—It may be prepared extemporaneously by the following process, which was official in the U. S. P. VIII:

	Metric	Old form
Silver Cyanide	**6.00 Gm.**	**93 gr.**
Diluted Hydrochloric Acid	**15.54 mils**	**252 min.**
Distilled Water	**44.10 mils**	**1½ fl. oz.**

Mix the diluted hydrochloric acid with the distilled water, add the silver cyanide, and shake the whole together in a glass-stoppered bottle. When the precipitate has subsided, pour off the clear liquid.

Diluted Hydrocyanic Acid may be made by the U. S. P. 1890 process, in which a solution of potassium ferrocyanide was mixed in a retort with diluted sulphuric acid, heated, and the hydrocyanic acid condensed and collected in a well-cooled receiver; the distillate was assayed and diluted with sufficient water to make a 2 per cent. solution.

$$(K_4FeCN_6)_2 + (H_2SO_4)_6 = K_2Fe_2CN_6 + (KHSO_4)_6 + 6HCN$$

Potassium Ferrocyanide — Sulphuric Acid — Potassium Ferrous Ferrocyanide (Everitt's Salt) — Potassium Acid Sulphate — Hydrocyanic Acid

Official Description.—A colorless liquid. On account of its poisonous character *it must be handled with great caution.*

Odor and Taste.—A characteristic odor resembling that of bitter almond; it is acid to litmus.

Tests for Identity.—Render 1 mil of the Acid alkaline with potassium hydroxide T.S., add a few drops of ferrous sulphate T.S., boil the mixture, and then acidulate with hydrochloric acid; a blue precipitate is formed.

Impurities and Tests for Impurities.—Not more than 0.002 Gm. of residue remains on evaporating 10 mils of Diluted Hydrocyanic Acid to dryness on a water bath.

Hydrogen Chloride.—Pour 5 mils of Diluted Hydrocyanic Acid into a tared, 100-mil, glass-stoppered flask containing 25 mils of distilled water, accurately determine the weight of the Acid added and then add 50 mils of tenth-normal silver nitrate V.S. and enough distilled water to make 100 mils. Agitate it well and filter through a dry filter; rejecting the first 10 mils of the filtrate. In 50 mils of the clear filtrate determine the excess of silver nitrate by titration with tenth-normal potassium sulphocyanate V.S., previously adding 2 mils of nitric acid and 2 mils of ferric ammonium sulphate T.S. From the number of mils of tenth-normal silver nitrate V.S. consumed in this assay subtract twice the number of mils of tenth-normal silver nitrate V.S. consumed in the assay of the same quantity of diluted Hydrocyanic Acid as ascertained below. The difference when calculated to free hydrogen chloride, using the factor 0.003647, does not amount to more than one-tenth of 1 per cent. of the weight of Diluted Hydrocyanic Acid originally taken for the determination.

Assay.—Pour about 5 mils of Diluted Hydrocyanic Acid into a 100-mil flask containing 25 mils of distilled water and 5 mils of potassium hydroxide T.S., the whole having been previously tared, and weigh the Acid accurately. Then add 3 drops of potassium iodide T.S. and titrate with tenth-normal silver nitrate V.S. to the production of a slight permanent precipitate. It shows not less then 1.9 per cent. nor more than 2.1 per cent. of HCN. Each mil of tenth-normal silver nitrate V.S. used corresponds to 0.005404 Gm. of HCN. Each gramme of Diluted Hydrocyanic Acid corresponds to not less than 3.5 mils nor more than 3.9 mils of tenth-normal silver nitrate V.S.

It is a solution of the very poisonous compound HCN in water. *Cyanogen,* CN or Cy, does not exist ready formed in nature, but compounds of it are found in plants and animal fluids. It is generally the product of chemical reaction, and was the first compound radical discovered. It is more closely related to the halogens in the character of its combinations than any other class of bodies. It unites with hydrogen to form hydrocyanic acid, HCN, and the compounds with metals and bases are termed cyanides. These have been considered in previous chapters.

Scheele's hydrocyanic acid is a stronger solution, containing about 5 per cent. of the anhydrous acid. Its use should be discouraged as unnecessary, tending to create confusion, and dangerous. Diluted hydrocyanic acid frequently becomes decomposed upon keeping, a black insoluble precipitate which contains paracyanogen forming in the bottle. This decomposition may be prevented by the addition of a small quantity of hydrochloric acid which is authorized by the Pharmacopœia. The use of cork-stoppered vials is said to be an advantage. Alcohol has not proved a good preservative.

Uses.—Diluted hydrocyanic acid is sedative in doses of one to three minims (0.05 to 0.2 mil). Potassium or sodium cyanide is often prescribed in combination with an acid and syrup, so that hydrocyanic acid may be generated and dissolved.

SINAPIS ALBA. U. S. White Mustard

[Sinap. Alb.—YELLOW MUSTARD]

The ripe seeds of *Sinapis alba* Linné (Fam. *Cruciferæ*), without the presence or admixture of more than 5 per cent. of other seeds or other foreign matter. Preserve powdered White Mustard in tightly-closed containers.

Official Description.—Sub-globular, from 1.5 to 2.5 mm. in diameter; testa yellowish, nearly smooth; embryo yellowish, oily, with two large cotyledons.

Odor and Taste.—Inodorous, taste mildly pungent, acrid.

Tests for Identity and Purity.—The powder is light yellowish or pale brownish-yellow, developing a slight odor when moistened; when examined under the microscope, it exhibits numerous tissues of the embryo containing small aleurone grains and a fixed oil, the latter forming in large globules on the addition of hydrated chloral T.S.; fragments of seed-coat comparatively few, nearly colorless, with small, characteristic stone cells and large epidermal cells, the outer walls being mucilaginous. The powder contains few or no starch grains.

White Mustard does not yield allyl isothiocyanate upon distillation with steam (distinction from *Black Mustard*).

White Mustard yields not more than 9 per cent. of ash.

White mustard seed contains *sinalbin*, $C_{30}H_{44}N_2O_{16}S_2$, a crystalline glucoside, which, under the influence of a peculiar ferment, *myrosin*, and water, is split into *acrinyl isothiocyanate*, $C_8H_7.NOS$, which is a pungent, volatile oil (this is not the official oil of mustard), *sinapine sulphate*, $C_{16}H_{23}NO_5H_2SO_4$, and glucose. The seed contains in addition 20 per cent. of fixed oil, mucilage, gum, etc., but no starch.

Uses.—It is used as a stimulant, condiment, and emetic; externally, it is rubefacient, but it is desirable to mix the ground drug with an equal quantity of flour or flaxseed meal, before preparing the homemade *mustard poultice*. This prevents its blistering and it should then be moistened with luke warm water. Hot water destroys the ferment, myrosin. The emetic dose is two and one-half drachms (10 Gm.) mixed with a little water.

SINAPIS NIGRA. U. S. Black Mustard

[**Sinap. Nig.**—Brown Mustard]

The ripe seeds of *Brassica nigra* (Linné) Koch (Fam. *Cruciferæ*), without the presence or admixture of more than 5 per cent. of other seeds or other foreign matter. Preserve powdered black mustard in tightly-closed containers.

Official Description.—Ellipsoidal or irregularly spheroidal, from 1 to 1.6 mm. in diameter; testa deep reddish-brown, sometimes yellowish-brown and with a grayish tinge, minutely pitted or reticulate; embryo greenish-yellow or dark yellow, oily, with two large cotyledons.

Odor and Taste.—Odor when dry, slight, on moistening very irritating; taste strongly pungent and acrid.

Tests for Identity and Purity.—The powder is light brown or greenish-brown; on moistening developing a strongly pungent, irritating, characteristic odor; when examined under the microscope it exhibits numerous tissues of the embryo, the cells containing small aleurone grains and a fixed oil, the latter forming in large globules on the addition of hydrated chloral T.S.; fragments of seed-coat conspicuous, with large, polyhedral, dark yellow areas, enclosing small, yellowish stone cells, each of the latter with a dark lumen. The powder contains few or no starch grains.

Black Mustard, upon distillation with steam, yields allyl isothiocyanate (distinction from *White Mustard*).

Black Mustard yields not more than 9 per cent. of ash.

Black mustard contains *sinigrin* or potassium myronate ($KC_{10}H_{19}NS_2O_{10}$), *myrosin*, a ferment, 25 per cent. of fixed oil, mucilage, etc. Under the influence of the myrosin and water, the potassium myronate is converted into *allyl isothiocyanate*, or volatile oil of mustard. This action takes place at ordinary temperatures, and explains the pungency of aqueous mixtures of ground mustard. *Mustard Plaster* is official (see *Emplastrum Sinapis.*)

Uses.—It is used as a stimulant, condiment, and emetic; externally, it is rubefacient. Both white and black mustard are used in making poultices.

OLEUM SINAPIS VOLATILE. U. S. Volatile Oil of Mustard

[**Ol. Sinap. Vol.**—Mustard Oil]

A volatile oil produced synthetically or obtained from the seed of *Brassica nigra* (Linné) Koch (Fam. *Cruciferæ*) (freed from fatty oil) by maceration with water and subsequent distillation. It yields not less than 92 per cent. of allyl isothiocyanate [$C_3H_5SCN = 99.12$]. The label must indicate whether the Oil has been made synthetically or obtained from black mustard. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

Preparation.—Chemically, this oil is *allyl isothiocyanate*, or *allyl thiocarbamide* $CS.NC_3H_5$; it is also called *allyl sulphocyanide*. Its production is explained in the preceding article. It is prepared artificially by the action of *allyl iodide* upon a solution of *potassium sulphocyanate*.

Official Description.—A colorless or pale yellow, strongly refractive liquid.

Odor and Taste.—A very pungent and irritating odor and an acrid taste.

Great caution should be exercised in smelling this Oil. It should not be tasted except when highly diluted.

Specific Gravity.—1.013 to 1.020 at 25° C. (77° F.).

Tests for Identity.—It is optically inactive.

Impurities and Tests for Impurities.—*Alcohol, Chloroform, Petroleum, or Fatty Oils.*—The Oil distils completely between 148° and 154° C. (298.4° and 309.2° F.) and both the first and last portions of the distillate have nearly the same specific gravity as the original Oil.

Phenols.—The addition of a drop of ferric chloride T.S. to the Oil, diluted with several volumes of alcohol, does not produce a blue coloration.

Assay.—Dilute about 4 mils of Volatile Oil of Mustard, accurately weighed, with sufficient alcohol to make exactly 100 mils. Transfer 5 mils of this solution to a 100 mil measuring flask, and add 50 mils of tenth-normal silver nitrate V.S. and 5 mils of ammonia water. Stopper the flask, connect it with a reflux condenser and heat it on a water bath during one hour. Allow it to cool, dilute the contents of the flask with distilled water to the 100-mil mark, mix well and filter. Add 4 mils of nitric acid and 2 mils of ferric ammonium sulphate T.S. to 50 mils of the filtrate and titrate the excess of the silver nitrate with tenth-normal potassium sulphocyanate V.S. When calculated from the weight of Oil taken for the assay it shows not less than 92 per cent. of allyl isothiocyanate. Each mil of tenth-normal silver nitrate V.S. consumed corresponds to 0.004956 Gm. of allyl isothiocyanate.

N. F. Preparations.—Linimentum Sinapis Compositum; Spiritus Sinapis.

Uses.—Volatile oil of mustard is used as a powerful rubefacient; it must be handled with great care; it is rarely given internally. Dose, one-eighth minim (0.008 mil).

ALLIUM. N. F. Garlic

The fresh bulb of *Allium sativum* Linné (Fam. *Liliaceæ*).

It contains a sulphuretted volatile oil having an exceedingly pungent odor and strong acrid taste.

Official Description.—Bulb subglobular, from 4 to 6 cm. in diameter, compound, consisting of from eight to fifteen bulbels and surrounded by one or two dry, whitish, membranaceous scales and attached to a flattened circular base, from the lower portion of which arise numerous yellowish-white roots; bulbels more or less ovoid, in transverse section three to four sided, the outer surface being convex, summit acute and narrowed into a thread-like fibrous portion, base truncate, each bulbel covered by one or two layers of whitish, membranaceous, scale-like leaves, beneath which is the light brown or pinkish, thin and coriaceous layer of epidermis, cohering but easily separable from the solid portion of the bulbel.

Odor and Taste.—Odor of broken or bruised bulbels powerfully alliaceous; taste intensely pungent and persistent.

Tests for Identity and Purity.—Under the microscope, transverse sections of the bulbel show three distinct portions: (a) the large fleshy scale consisting chiefly of parenchyma enclosing scattered vascular bundles, epidermis in both ventral and dorsal surfaces consisting of small tabular cells; (b) the middle layer nearly circular in outline, about 0.75 mm. in diameter, the tissues resembling those of the outer fleshy scale, but the cells containing numerous yellowish-brown plastids; (c) an innermost bright green layer consisting of a single leaf folded lengthwise along the midrib so that the ventral surfaces lie close together.

N. F. Preparation.—Syrupus Allii.

Uses.—It is sometimes employed as a rubefacient, carminative and condiment. The syrup is used as an expectorant. The dose is thirty grains (2 Gm.).

Unofficial Volatile Oils, Drugs, and Allied Products

Oil of Asafetida	From *Asafetida.* Fam. *Umbelliferæ.* Habitat, Western Thibet. The yield is about 6 to 9 per cent.
Bitter Candytuft	*Iberis amara* contains a sulphurated volatile oil
Common Scurvy Grass	From the herb of *Cochlearia officinalis.* Fam. *Cruciferæ.* Habitat, Europe
Cress	The seed of *Lepidium sativum.* Fam. *Cruciferæ.* Contains a sulphurated volatile oil
Oil of Garlic Allyl sulphide, $(C_3H_5)_2S$	Obtained artificially by decomposing allyl iodide with an alcoholic solution of potassium sulphide
Hedge Garlic	*Alliaria officinalis.* Fam. *Cruciferæ.* Contains a sulphurated oil
Horseradish	From the root of *Cochlearia Armoracia.* Fam. *Cruciferæ.* Habitat, Europe. The yield is about $^1/_{20}$ per cent.
Radish	*Raphanus sativa* contains a sulphurated volatile oil
Sagapenum	From *Ferula persica.* The yield of volatile oil is small

Unofficial Volatile Oils, Drugs, and Allied Products—*Continued*

Shepherd's Purse	The seeds of *Capsella bursa-pastoris* contain a sulphurated volatile oil
Wallflower	The seed of *Cheiranthus annuus* contains a sulphurated volatile oil
Wild Mustard	The seed of *Sisymbrium nasturtium* contains a sulphurated volatile oil
Wild Radish	The seed of *Raphanus Raphanistrum* contains a sulphurated volatile oil
Allyl Tribromide, $C_3H_5Br_3$	A slightly yellowish liquid, identical with *Tribromhydrin;* sedative and anodyne in its action. Dose, five or six drops
Camphoric Acid, $H_2C_{10}H_{14}O_4$, U. S. P. VIII	A dibasic organic acid $[C_8H_4(COOH)_2]$, obtained by the oxidation of camphor. Used in the treatment of bronchitis and phthisis in doses of fifteen grains (1 Gm.)
Thiosinamin, Allyl-sulpho-urea, Allyl-sulpho-carbamide, $CS\left\{\begin{matrix}NH_2\\NH(C_3H_5)\end{matrix}\right.$	Used in tuberculous diseases, by subcutaneous injection, of four and one-half to seven grains (0.3 to 0.45 Gm.), in 15 per cent. alcoholic solution

QUESTIONS ON VOLATILE OILS

What are volatile oils, and whence are they obtained? (See page 1104.)

What other terms are applied to these oils?

What are the most important constituents found in volatile oils?

Into what classes may the hydrocarbons from volatile oils be divided?

What are the solubilities of terpenes?

Name and describe the most important alcohols obtained from volatile oils.

Name and describe the most important aldehydes obtained from volatile oils.

Name and describe the most important ketones obtained from volatile oils.

Name and describe the most important esters obtained from volatile oils.

Name and describe the most important phenols and phenol ethers obtained from volatile oils.

Name and describe the most important neutral bodies, oxides, etc., obtained from volatile oils.

Name and describe the most important sulphides and sulphur compounds obtained from volatile oils.

What are the characteristics of oxygenated oils?

What is the color of most volatile oils when pure?

What effect does exposure to air have upon the color?

What is the most characteristic feature of volatile oils?

In what manner does the taste of volatile oils vary?

What variation exists in the specific gravity of volatile oils?

What is meant by "optical activity"? By "refractive index"?

What occurs when volatile oils are heated?

What are good solvents of volatile oils, and of what substances are they solvents?

What effect does exposure to light and air have on them?

How should they be kept?

What effect does strong nitric acid have upon them?

What effect does strong iodine have upon them?

How are they affected by alkalies?

How may their adulteration with fixed oils be detected?

How may the presence of alcohol be detected?

How may the presence of inferior qualities of the same kind of oil be detected?

In what ways are volatile oils obtained from plants?

What is the method most frequently employed?

What is the general formula for this process?

How should dried substances be treated before being subjected to distillation?

What purposes does water serve in distilling vegetable substances along with it?

When vegetable substances contain volatile oils which do not readily distil at the temperature of boiling water, how are they treated?

Where oils are injured by heat, and it is desirable to distil them at as low a temperature as possible, how may the distillation be accomplished?

What will be the effect where too much water is used?

What will be the effect where not enough water is used?

What is the process known as cohobation?

How may oils be freed from the disagreeable odor which they are apt to have when first procured?

When altered by exposure to air, how may they be partially restored to their former quality?

What is meant by distillation "per se"?
In what cases and for what reason is this used?
Expression—Is this a good method of obtaining oils?
What is the principal objection to it?
What is meant by the process of solution or absorption?
How is the process of maceration conducted?
How is the process of digestion conducted?
What is the process known as enfleurage?
How is the "pneumatic process" conducted?
How are oils prepared by the "percolation process"?
What is meant by synthetic perfumes?
Bitter orange peel—Give the Latin official name. Whence is it obtained?
Describe its appearance, odor, taste, and tests for identity and purity.
What principles does it contain? What is the dose?
What are its official preparations?
Sweet orange peel—Give the Latin name. Whence is it obtained?
To what does it owe its virtues, and for what is it used?
What are its official preparations?
Oil of orange—Give the Latin official name and synonyms. How is it obtained?
What is its composition? Give description and specific gravity.
How may an impurity of oil of turpentine be detected?
How may it be preserved from the effects of oxidation?
For what is it used?
What preparations of this oil are official?
What is lemon peel, and for what is it used?
What does it contain?
Oil of lemon—What is the Latin official name? How is it obtained?
Describe an "ecuelle" and illustrate its use.
What is its chemical composition? Give description, specific gravity, and tests for identity.
Describe the assay for citral.
Oil of bitter orange—How is it obtained?
How should it be preserved?
Describe its appearance, odor, and taste. Give specific gravity and solubility and important tests.
For what is it used?
Oil of orange flowers—What is the Latin title and synonym? What is its surce? Give description and tests.
For what is it used?
Oil of bergamot—What is its source? Name the important constituent. Give description and tests. For what is it used?
Peppermint—What is the Latin official name? What part of the plant is official?
Describe the plant. In what official preparation is it used?
To what are its properties due?
Oil of peppermint—What percentage of ester and what percentage of menthol should be present in this oil? Give Latin name, description, odor, taste, chemical reaction, specific gravity, solubility, and tests for identity.
How is it assayed?
What are the most important constituents?
What are the official preparations of oil of peppermint? What are its uses?
What is menthol? How is it prepared? Describe odor, taste, chemical reaction, and solubility. What are the tests for identity?
How may the following impurities be detected?—viz.: Wax, paraffin, or inorganic substances; thymol.
For what is it used? Name the N. F. preparations.
Camphorated menthol—What is the Latin title and synonym?
How is it made? Give its uses.
Spearmint—What is the Latin official name? To what does it owe its properties?
What is the yield of volatile oil?
Oil of spearmint—What constituents are present? What is the U. S. P. requirement? Describe odor, taste, solubility, and tests for identity.
Give its specific gravity.
What does it contain? For what is it used?
What are its official preparations?

Oil of lavender—What is the Latin name? By what name is it commonly sold? Name the most important constituents. Describe appearance, odor, taste, and solubility.
What is its specific gravity? How may alcohol or foreign esters be detected?
What preparations of it are official?
Where does the best quality come from?
Oil of rosemary—What percentage of ester and what percentage of borneol should it contain? What is the Latin name? Name the most important constituents. Give description and specific gravity.
Give the tests for identity. Describe the assay.
Of what does it consist?
In what preparations is it used?
Thyme—Give Latin title and definition. When should it be collected? What is its chief constituent?
Name its N. F. preparation.
What are its uses and the dose?
Oil of thyme—What is the name of the herb from which it is obtained?
What percentage of phenols should be present?
By what name is this oil known commercially?
What is the difference between the red oil and the white oil?
Does this oil vary in composition?
Of what does the more volatile portion consist? What is the less volatile portion?
What is the formula in symbols of the latter?
In what other oil is this substance found?
Give description and specific gravity. Describe the odor, taste, chemical reaction, and solubility.
Give tests for identity. How may an impurity of phenol be detected? Describe the assay.
For what purpose is oil of thyme used?
Thymol—What are the sources of this substance? How may it be prepared?
Describe its appearance, odor, taste, reaction, and rotation.
What are its solubilities and tests for identity and purity?
In what N. F. preparations is it used?
What are its uses?
Thymol iodide—What is this substance? By what name is it commonly known? How much iodine should it represent? How may it be made?
Describe its appearance, odor, solubility, and tests for identity and purity.
What are its uses?
Catnep—What is the Latin title and synonym? Describe its odor and taste.
What preparation is official?
Name its constituents and uses.
Scutellaria—What is the name of the plant from which it is derived?
What is its synonym? What does it contain? For what is it used?
What official preparation is made of it?
Mention other plants of the Labiatæ.
Caraway—What is the official Latin title? From what plant is it derived?
What does it contain? What are its medicinal properties?
Oil of caraway—What is the U. S. P. requirement? Name its most important constituents. What is its specific gravity? Describe its appearance, odor, taste, chemical reaction, and solubility. Of what does it consist? For what is it used? Give the dose.
Fennel—What is the Latin name? From what plant is it derived?
Describe its appearance, odor, and taste.
What does it contain? For what is it used?
Oil of fennel—What are its constituents? What is its specific gravity? Describe odor, taste, chemical reaction, and solubility. Give tests for identity. How may the presence of other volatile oils containing phenols be detected?
What official preparation is made of it? What are its uses and dose?
Coriander—What is its source? Give the synonym.
Describe its appearance.
In what N. F. preparations is it used?
How much volatile oil does it yield?
How much fixed oil does it yield? What are its uses?
Oil of coriander—What are its constituents? What is its specific gravity?

Describe odor, taste, chemical reaction, and solubility. Give the test for identity.
For what is it used?
Sumbul—From what plant is it derived?
What is the synonym?
What does it contain, and for what is it used?
What official preparation is made of it?
Anise—From what plant is it derived?
Describe the appearance and characteristics.
How may the presence of conium be detected?
What does it contain? For what is it used?
Oil of anise—From what plants is it obtained?
Are these products identical? What are the most important constituents? In what other oils is the chief constituent found? What is its specific gravity?
Describe odor, taste, chemical reaction, and solubility.
What are the tests for identity and purity?
What preparations of it are official?
Anethol—What is this substance?
How is it obtained? Describe its appearance, odor, and taste. Give its solubility, specific gravity, and tests for identity and purity.
What are its uses and synonym?
Angelica fruit—What is its source and synonym?
Describe its appearance, odor, and taste.
What are its N. F. preparations and uses?
Angelica root—What is its source?
Describe its appearance, odor, and taste.
Name its official preparation. For what is it used?
Parsley fruit—What is the Latin title and synonym? What is its source? Name the most important constituents.
Describe its appearance, odor, and taste.
Name its official preparation and uses.
Parsely root—What is its Latin title?
Describe its appearance, odor, and taste.
Name its N. F. preparation and uses.
Celery fruit—What is the Latin title and synonym? Give its source.
What constituents are present?
Describe appearance, odor, and taste.
What is its N. F. preparation, use, and dose?
Name other unofficial drugs of the Umbelliferæ.
Saigon cinnamon—Give the Latin official name.
What is the source of Saigon cinnamon?
How is it officially described?
Name the more important official preparations in which it is used.
Ceylon cinnamon—Give the Latin official title. What is its source?
How is it officially described?
To what does cinnamon bark owe its virtues?
What other constituents are present?
What are its uses?
Oil of cinnamon—What is the official Latin title? By what other English title is it known? What percentage of cinnamic aldehyde should it contain?
Describe appearance, odor, taste, and solubility. What are the specific gravity and tests for identity and purity?
Give chemical reaction, specific gravity, solubility; percentage of cinnamic aldehyde and eugenol and congealing point of oil of Ceylon cinnamon.
In what respect does the oil of cassia differ from oil of Cevlon cinnamon?
What constituents are present?
When slightly oxidized what is produced?
Upon further oxidation what is produced?
Why is cinnamon water made from Ceylon cinnamon cloudy?
Cinnamic aldehyde—What is the official Latin title?
Give chemical formula in symbols.
What is the synonym? How may it be obtained?
Give description, odor, taste, specific gravity, solubility, and tests for identity.
How may an impurity of chlorinated products be detected? Describe the assay.
Name the more important official preparations made from oil of cinnamon.

Clove—What is the Latin name? What is its source?
Describe appearance, odor, and taste.
What are the most important constituents?
For what is it used? Into which official preparations does it enter?
Oil of clove—What percentage of eugenol should it contain? What is the Latin name?
Of what does the oil of clove consist?
How may these oils be separated?
What combination is formed when oil of clove is mixed with a concentrated solution of potassium hydroxide?
What is the composition and specific gravity of light oil of clove?
Heavy oil of clove—Give description and specific gravity.
What is its boiling point?
Of what does it consist, and what effect does it have on alkalies?
Into what principle may eugenol be converted?
Give description, odor, taste, specific gravity, solubility, and tests for identity.
How may phenol as an impurity be detected?
Describe the assay for eugenol.
Name its more important N. F. preparations.
What is its use and dose?
Eugenol—What is its natural source and how is it separated?
Give description, odor, taste, specific gravity, solubility, and tests for identity.
How may phenol, as an impurity, be detected?
For what is it used? Give the dose.
Oil of pimenta—What is the synonym? What percentage of eugenol should it contain? Describe the assay for eugenol. What is the specific gravity?
Describe odor, taste, chemical reaction, and solubility.
Of what does it consist?
For what is it used?
What is pimenta? What is the synonym?
How much volatile oil does it contain?
Vanilla—What is its source? Give the constituents.
Considered chemically, what is vanillin?
How is the agreeable odor and taste of vanilla bean developed?
Describe its appearance, odor, and taste.
What are its uses?
What N. F. preparations contain vanilla?
Vanillin—What is it chemically? What are the sources and how is it made artificially?
Is the flavor of vanillin equal to that of the natural vanilla bean?
Give description, odor, taste, chemical reaction, solubility, and tests for identity and purity.
Name the more important N. F. preparations in which it is an ingredient.
For what is it used? Give the dose.
Coumarin—What is this substance? Describe its appearance, odor, and taste.
What impurities must be guarded against?
What are its uses?
Oil of cajuput—From what is it obtained?
What are its chief constituents?
Describe odor, taste, and chemical reaction.
What is its solubility? Its specific gravity?
To what is its green color due?
Give tests for identity and for the presence of copper as an impurity.
For what is it used? Give the dose.
Eucalyptus—What is the synonym? From what tree is it obtained? How is it described?
What are its constituents?
Upon which of these do the virtues depend?
What are its properties?
What official preparation is made from it?
Oil of eucalyptus—What is its source? What percentage of eucalyptol should it contain? What is another name for eucalyptol?
Name the chief constituents.
Give tests for identity and impurity. What is its specific gravity?

Describe odor, taste, chemical reaction, and solubility.
What are its uses and dose?
Eucalyptol—Give the chemical formula and synonyms.
What is it chemically and from what source is it obtained?
At what temperature does it congeal or form crystals?
Give description, odor, taste, specific gravity, solubility, and tests for identity and purity.
For what is it used? Give the dose.
Oil of myrcia—Give the synonym. What is its source?
Describe and give official tests.
What are its uses?
Myristica—What is it? What is the common name?
How is myristica officially described?
To what does it owe its activity?
How much fixed oil does it contain?
In how many official preparations is it found? Name them.
Oil of myristica—What is the Latin name? What is the synonym? What is its source?
What are its chief constituents?
Give description, odor, taste, specific gravity, solubility, and tests for identity.
Of what does it consist?
Expressed oil of nutmeg—What is this usually called?
How is it made? What is its chemical composition?
What official preparations are made from oil of myristica?
Mace—What is the Latin title? What is mace? What are its chief constituents?
Describe its appearance, odor, and taste.
What are its uses and the dose?
Sassafras—What is its source? How is it described officially?
What are its constituents?
For what is it used, and into what preparations does it enter?
Oil of sassafras—Describe it. What is its specific gravity?
Name the most important constituents.
Describe odor and taste. Give tests for identity.
Where is it largely produced, and what is the yield?
Of what does it consist?
Safrol—What is the chemical formula in symbols? What is it chemically? What are its natural sources and how is it obtained? For what is it used?
Give description, odor, specific gravity, solubility, and tests for identity and purity for the oil. For what is it used?
Methyl salicylate—What substances are included under this title?
How must each be indicated?
How is it prepared from the several sources?
Describe its appearance, odor, taste, and reaction.
Give its solubility. What differences are noted in specific gravity when synthetic or natural?
What impurities are likely to be present and how detected?
Name the official preparations in which it is used.
What are its uses and the dose?
Rectified oil of birch tar—What are the Latin title and synonyms? What is this substance?
Name the chief constituents.
Describe its appearance, odor, taste, and other important characteristics.
What are its uses?
Cardamom seed—Give the Latin name and synonym.
What is the official definition? From what country is it imported?
What do the seeds contain?
Into what official preparations does it enter?
What are its uses and the dose?
Oil of cardamom—Describe. Give tests.
Into what N. F. preparations does it enter?
What are its uses?
Ginger—What is its Latin title? Give the official definition and description. Name the several kinds of ginger recognized by the U. S. P. To what does it owe its virtues?

How much volatile oil does it contain? What other important constituents are present?
Name its official preparations. In what dose is it administered?
Zedoary—What is the Latin title? Describe its appearance, odor, and taste.
Name the N. F. preparations.
What are its uses and dose?
Asarum—What are its synonyms?
Give the source. What is its chief constituent and use?
Describe its appearance, odor, and taste.
Name its N. F. preparation. Give medicinal use and dose.
Camphor—What is the Latin title?
What is camphor?
How is refined camphor usually made?
What is compressed camphor?
How is synthetic camphor prepared?
Describe its appearance, odor, taste, and solubility?
Give its specific gravity and identity tests. What impurities may be present and how detected?
What occurs if camphor is triturated with menthol, thymol, phenol, hydrated chloral, etc.?
What are the more important official preparations of camphor?
For what is it used medicinally? Give the dose.
How is it administered hypodermically?
Monobromated camphor—Give Latin name and formula in symbols.
Describe a process for making monobromated camphor.
Describe its appearance, odor, taste, chemical reaction, and solubility. Give tests for identity and purity.
For what is it used medicinally? What is the dose?
Oil of bitter almond—Give Latin official name. What are its sources? What requirement is in the U. S. P. concerning its source?
What percentage of benzaldehyde should this oil contain? What amount of hydrocyanic acid?
Does this oil pre-exist in the almond?
Why can it not be obtained from sweet almond?
How is it made? Give description, odor, taste, reaction, specific gravity, solubility and tests for identity.
How may impurities of heavy metals, chlorinated products, and nitrobenzene be detected?
Describe the assay for benzaldehyde; for hydrocyanic acid. For what is this oil used?
What precaution must be taken in its use? Give the dose.
Name the official preparations made from this oil.
Benzaldehyde—Give the Latin official title and the chemical formula in symbols.
What percentage of pure benzaldehyde should it contain? How may it be made?
Does this substance contain hydrocyanic acid? What is nitrobenzene? What is its common name? For what is nitrobenzene used?
Is it in any way identical with benzaldehyde?
Give description, odor, taste, specific gravity, solubility, and test for identity.
How may the following impurities be detected?—Hydrocyanic acid; chlorinated products; nitrobenzene. Describe the assay. For what purpose is benzaldehyde used?
Wild cherry—What is the Latin name? Of what tree is this the bark?
When should it be collected?
Describe its appearance, odor, and taste.
What does it contain?
Why should the preparations of wild cherry be made without heat?
What are its properties?
What official preparations are made from it?
Diluted hydrocyanic acid—What is the Latin name? What is its synonym and the P. I. title?
How much absolute hydrocyanic acid should it contain?
How may it be prepared extemporaneously? By what other method may it be prepared? How may it be assayed?
How may it be identified? Give appearance, odor, taste, and reaction. Should it be tasted?

What is cyanogen? Does it exist ready formed in nature?
Combined with hydrogen, what does it form?
Combined with metals and bases, what are formed?
What is Scheele's hydrocyanic acid?
When hydrocyanic acid is decomposed upon keeping what substance is formed?
How may its decomposition be prevented or lessened? What are its uses and the dose?
What is the effect of prescribing cyanide of potassium in combination with an acid?
White mustard—What is the Latin name? Give the official definition and description. What does it contain?
Under the influence of myrosin and water, into what substances is sinalbin decomposed?
Is this volatile oil the official oil of mustard?
What are the other constituents of white mustard?
Does it contain starch? For what is it used? What is the emetic dose? How may a poultice best be prepared? Why should luke warm water be used in making a poultice?
Black mustard—What is the Latin name? Give the official definition and description. What does it contain?
Under the influence of myrosin and water, into what is potassium myronate converted?
Does this action take place at ordinary temperatures?
What official preparation is made from black mustard?
Volatile oil of mustard—What is the Latin name? What percentage of allyl isothiocyanate should it contain? How is it obtained?
What is this oil chemically considered?
How is it prepared artificially? Give description and specific gravity.
Describe odor, taste, and solubility.
Give the test for identity and purity.
Describe the assay for allyl isothiocyanate. For what is it used? Give the dose.
Garlic—What is the Latin title? Give its source and constituents.
Describe its appearance, odor, and taste.
What is its N. F. preparation? Give the use and dose.

CHAPTER LVI

OFFICIAL DRUGS AND PRODUCTS CONTAINING VOLATILE OIL WITH SOFT RESIN

PIPER. U. S. Pepper
[BLACK PEPPER]

THE dried, unripe fruit of *Piper nigrum* Linné (Fam. *Piperaceæ*), without the presence or admixture of more than 2 per cent. of stems or other foreign matter.

Official Description.—Nearly globular, from 3.5 to 6 mm. in diameter, epicarp very thin, easily separable from the sarcocarp; externally blackish-brown or grayish-black, coarsely reticulate; unilocular, 1-seeded; seed nearly white, hollow, adhering to the pericarp.

Odor and Taste.—Odor aromatic, slightly empyreumatic; taste aromatic and very pungent.

Tests for Identity and Purity.—The powder is a mixture of blackish-brown fragments of the pericarp and nearly white fragments of the endosperm and embryo; starch grains spherical or somewhat angular, from 0.001 to 0.003 mm. in diameter, mostly in the polygonal cells of the endosperm; stone cells of the epicarp varying from nearly isodiametric or palisade-like to long tapering or somewhat irregular in shape, with thick porous walls and large lumina frequently containing a reddish-brown pigment; stone cells of the endocarp unevenly thickened, the outer walls being usually rather thin, and the lumina usually filled with a reddish-brown substance; oil cells with suberized walls and containing a yellowish oil, from which monoclinic prisms of piperine occasionally separate.

Pepper yields not less than 6 per cent. of non-volatile extract, soluble in ether (see U. S. P., Test No. 13, Chapter LXII). It contains not less than 25 per cent. of starch.

Pepper yields not more than 7 per cent. of ash. The amount of ash in Pepper, insoluble in diluted hydrochloric acid, does not exceed 2 per cent. of the weight of Pepper taken.

U. S. P. Preparation.—Oleoresina Piperis.

N. F. Preparations.—Tinctura Antiperiodica; Tinctura Antiperiodica sine Aloe.

Black pepper contains piperine, 2 per cent. of volatile oil, and a pungent resin soluble in alcohol and ether. The volatile oil is a terpene, $C_{10}H_{16}$.

Uses.—The principal use of pepper is as a condiment and for the making of the oleoresin. Dose, eight grains (0.5 Gm.).

Piperine was official in the U. S. P. VIII and was described as a feebly basic substance ($C_{17}H_{19}NO_3$), obtained from pepper and other plants of the *Piperaceæ*. It is obtained by treating pepper with alcohol, evaporating the tincture to the consistence of an extract, submitting the extract to the action of an alkaline solution, by which the oleaginous matter is converted into soap, washing the undissolved portion with cold water, separating the liquid by filtration, treating the matter left on the filter with alcohol, and allowing the solution thus obtained to evaporate spontaneously, or by a gentle heat. Crystals of piperine are deposited, and may be purified by alternate solution in alcohol or ether, and crystallization. Piperine is decomposed by alkalies in alcoholic solution into *piperic acid*, $C_{12}H_{10}O_4$, and *piperidine*, $C_5H_{11}N$. It is considered to be an alkaloid of feeble power. It consists of colorless or pale yellowish, glistening, monoclinic crystals; permanent in the air and containing no water of crystallization. Optically inactive. When put into the mouth, it is at first tasteless, but on prolonged contact develops a sharp, biting taste; odorless; neutral reaction; insoluble in water; soluble in 15 parts of alcohol at 25° C. (77° F.); in 4.4 parts of alcohol at 60° C. (140° F.); also soluble in 36 parts of ether and 1.7 parts of chloroform at 25° C. (77° F.).

Uses.—Piperine has been used as a stimulant and an antiperiodic. Its virtues, however, in this connection depend principally upon its impurities, —*i.e.*, adhering resin and oil. When absolutely pure and colorless it has but little medicinal action. Dose, three grains (0.2 Gm.).

CUBEBA. U. S. Cubeb
[Cubeb.—Cubebs]

The dried, full-grown, unripe fruits of *Piper Cubeba* Linné filius (Fam. *Piperaceæ*), without the presence or admixture of more than 5 per cent. of stems or other foreign matter.

Official Description.—Upper portion globular, from 3 to 6 mm. in diameter, with a straight, slender stem-like portion, from 5 to 7 mm. in length; pericarp externally grayish, brownish, or bluish-black; coarsely reticulate; about 0.3 mm. in thickness, easily cut, 1-locular, 1-seeded; the immature seed attached at the base of the pericarp.

Odor and Taste.—Odor aromatic, characteristic; taste strongly aromatic and pungent.

Tests for Identity and Purity.—Under the microscope, sections of Cubeb show an epidermal layer of tabular cells with thickened, undulate outer walls, the contents being olive-green; 1 or 2 rows of parenchyma cells, the contents resembling those of the epidermal cells; a continuous layer of radiately elongated, thick-walled stone cells having numerous pores; a few layers of collapsed cells near which may occur an occasional small group of bast-fibers; a middle layer of 10 rows of cells composed chiefly of parenchyma, scattered among which are numerous secretion cells containing a volatile oil and occasionally crystals in the form of short rods, the contents of the secretion cells being colored a deep crimson upon the addition of sulphuric acid; an endocarp of small, somewhat isodiametric or polygonal stone cells with very thick porous walls; seed-coat of several rows of reddish-brown, tangentially elongated, more or less collapsed cells; perisperm of numerous thin-walled parenchyma, the cells being more or less polygonal in shape and containing either small compound starch grains, or globules of a fixed oil or occasionally a crystal of calcium oxalate.

The powder is light brown to blackish-brown, consisting of a more or less even distribution of starch-bearing cells of the perisperm and fragments of the pericarp with stone cells; starch grains numerous, single or compound, from 0.002 to 0.012 mm. in diameter; stone cells numerous in palisade-like groups, in surface view rounded or polygonal with rather prominent dark lumina and yellowish porous walls; secretion cells with a yellowish, oily content, becoming reddish on the addition of sulphuric acid; fragments of stalk few, with spiral tracheæ and groups of sclerenchymatous fibers from 0.05 to 1 mm. in length with blunt, rounded, or very much attenuated ends, the walls strongly lignified and with numerous oblique pores.

Cubeb yields not less than 10 per cent. of volatile extractive, soluble in ether (see U. S. P., Test No. 12, Chapter LXII).

Cubeb yields not more than 8 per cent. of ash.

U. S. P. Preparation.—Oleoresina Cubebæ.

N. F. Preparations.—Elixir Buchu Compositum (from Compound Fluidextract of Buchu); Fluidextractum Buchu Compositum; Fluidextractum Cubebæ; Pilulæ Antiperiodicæ; Pilulæ Antiperiodicæ sine Aloe; Tinctura Antiperiodica; Tinctura Antiperiodica sine Aloe; Tinctura Cubebæ.

Uses.—This useful fruit, or berry as it is commonly called, contains about 10 per cent. of volatile oil, 3 per cent. of resin, *cubebin*, *cubebic acid*, wax, fat, etc. The virtues of cubeb reside in the cubebic acid, resin, and oil, cubebin when pure being destitute of activity. Cubebic acid, cubebic resin, and cubebin are all colored red by strong sulphuric acid. Cubeb is used as a diuretic, stimulant, and expectorant in doses of fifteen to sixty grains (1 to 4 Gm.).

OLEUM CUBEBÆ. U. S. Oil of Cubeb

[Ol. Cubeb.—CUBEB OIL]

A volatile oil distilled from the unripe fruit of *Piper Cubeba* Linné filius (Fam. *Piperaceæ*). Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

Official Description.—A colorless or a pale green to yellowish-green liquid.

Odor, Taste, and Reaction.—Characteristic odor and taste of cubeb. Its alcoholic solution is neutral to litmus.

Specific Gravity.—0.905 to 0.925 at 25° C. (77° F.).

Test for Identity and Purity.—Its optical rotation varies from −20° to −40° in a 100-mm. tube at 25° C. (77°F.) (see U. S. P., Test No. 21, Chapter LXII).

The oil consists chiefly of sesquiterpenes which distil over between 250° and 280° C. (482° and 536° F.), one of which is *cadinene*, $C_{15}H_{24}$, with some dipentene, and probably pinene or camphene. Upon standing, it sometimes deposits rhomboidal prismatic crystals of a stearopten. The camphor of cubeb has the formula $C_{15}H_{26}O$, is fusible at from 66° to 68° C. (150.8°–154.4° F.), and volatilizes without change from 148° to 150° C. (298.4°–302° F.). According to Schmidt, it does not pre-exist in the cubeb, but is formed by the prolonged action of the air and therefore does not occur in the oil distilled from new berries.

Uses.—Oil of cubeb is an aromatic stimulant and carminative. Dose, eight minims (0.5 mil).

CAPSICUM. U. S. Capsicum

[Capsic.—CAYENNE PEPPER' AFRICAN CHILLIES]

The dried ripe fruits of *Capsicum frutescens* Linné (Fam. *Solanaceæ*), without the presence or admixture of more than 2 per cent. of stems, calyxes or other foreign matter.

Official Description.—Oblong-conical, from 8 to 20 mm. in length and from 2 to 15 mm. in diameter; pericarp brownish-red or orange, shining, membranous and translucent; 2- or 3-locular, united below, and containing 6 to 17 flat, reniform, yellowish seeds attached to the placenta or frequently separated from it.

The calyx, when present, light greenish-brown, inferior, inconspicuous, 5-toothed, usually attached to a long straight peduncle.

Odor and Taste.—Odor characteristic, sternutatory; taste intensely pungent.

Tests for Identity and Purity.—The powder is yellowish-brown; mounts made with hydrated chloral T.S. and examined under the microscope show yellowish-red oil globules; stone cells of two kinds, those of the endocarp being more or less elongated, walls yellowish, uniformly and moderately thickened, wavy in outline, porous and slightly lignified, those of the seed-coat being yellowish, irregular and strongly thickened, wavy in outline and strongly lignified.

Capsicum yields not less than 15 per cent. of non-volatile extractive, soluble in ether (see U. S. P., Test No. 13, Chapter LXII).

Capsicum yields not more than 7 per cent. of ash. The amount of ash, insoluble in hydrochloric acid, does not exceed 1 per cent. of the weight of Capsicum taken.

U. S. P. Preparations.—Oleoresina Capsici; Tinctura Capsici.

N. F. Preparations.—Mistura Chloroformi et Morphinæ Composita (from Tincture); Mistura Opii et Chloroformi Composita (from Tincture); Mistura Opii et Rhei Composita (from Tincture); Pulvis Aromaticus Rubifaciens; Pulvis Myricæ Compositus; Tinctura Capsici et Myrrhæ.

The principal constituents of capsicum are capsaicin, $C_9H_{14}O_2$, traces of a volatile alkaloid and a volatile oil, fixed oil, resin, coloring matter, etc. *Capsaicin* is in colorless crystals, volatile, intensely acrid, and soluble in alcohol, ether, and fixed oils.

Uses.—Capsicum is stimulant and rubefacient. Dose, one grain (0.065 Gm.).

COPAIBA. U. S. Copaiba

[Copaib.—Balsam of Copaiba Copaiva]

An oleoresin derived from South American species of *Copaiba* (Fam. *Leguminosæ*).

Copaiba is mostly imported from Para in Brazil, Maracaibo in Venezuela, and other South American ports. It contains *copaivic acid*, volatile oil, and a bitter principle. Copaivic acid, $C_{20}H_{30}O_2$, the resinous mass left after distilling the oil, forms a series of amorphous salts. (See Massa Copaibæ.) It may be obtained pure by exposing a mixture of nine parts of copaiba and two parts of aqueous ammonia (sp. gr. 0.95) to a temperature of 10° C. (50° F.). Copaiba is often adulterated.

Oil of copaiba was official in the U. S. P. VIII and was described as a colorless or pale yellow liquid having the characteristic odor of copaiba and an aromatic, slightly bitter and pungent taste. The specific gravity is 0.985 to 0.905 at 25° C. (77° F.), increasing with age. It is lævogyrate. It is used as a stimulant, and for the same purposes as copaiba. Dose, five to ten minims (0.3 to 0.6 mil).

The U. S. P. description and tests for Copaiba are as follows:

Official Description.—A pale yellow to brownish-yellow, more or less viscid liquid, either without fluorescence or with only a slightly greenish fluorescence.

Odor, Taste, and Reaction.—A peculiar, aromatic odor and a persistent, bitter, and acrid taste.

Solubility.—Insoluble in water and partly soluble in alcohol. Soluble, showing not more than a slight opalescence, in dehydrated alcohol, carbon disulphide, or in fixed or volatile oils; completely soluble in chloroform or ether and also soluble in an equal volume of petroleum benzin, a further addition of the solvent producing a flocculent precipitate.

Specific Gravity.—0.940 to 0.995 at 25° C. (77° F.).

Tests for Identity and Purity.—*Paraffin or Fatty Oils.*—When heated on a water bath, no odor of oil of turpentine is evolved; and when all of the volatile oil has been driven off, a hard and brittle resin remains, weighing not less than 36 per cent. of the original weight of the Copaiba taken.

To about 1 Gm. of Copaiba, accurately weighed, add 50 mils of alcohol, and 1 mil of phenolphthalein T.S., then titrate the solution with half-normal potassium hydroxide V.S. It shows an acid value of not less than 28 nor more than 95.

Gurjun Balsam.—Dissolve 3 or 4 drops of the volatile oil separated from Copaiba by distillation with steam, in 3 mils of glacial acetic acid, mix the solution with 1 drop of a freshly prepared aqueous solution of sodium nitrite (1 in 10), and carefully underlay this with 2 mils of sulphuric acid. The acetic layer is not colored pink.

Paraffin Oils.—Shake 5 mils of Copaiba with 15 mils of alcohol and then heat the mixture to boiling for one minute; no oil separates after cooling and allowing it to stand for one hour.

African Copaiba.—The volatile oil separated from Copaiba by distillation with steam does not boil below 250° C. (482° F.) and shows an angle of rotation in a 100-mm. tube of not less than -7° at 25° C. (77° F.).

N. F. Preparations.—Massa Copaibæ; Mistura Copaibæ; Mistura Copaibæ et Opii.

Uses.—Copaiba is stimulant and diuretic, and has a special irritant action upon the mucous membranes of the urinary passages. Dose, from fifteen minims to one fluidrachm (1 to 4 mils).

MASSA COPAIBÆ. N. F. **Mass of Copaiba**

[**Mass. Copaib.**—SOLIDIFIED COPAIBA]

	Metric	Old form
Copaiba	94 Gm.	3 oz. av. 332½ gr.
Magnesium Oxide	6 Gm.	105 gr.
Water, a sufficient quantity,		
To make about	100 Gm.	4 oz. av.

Triturate the magnesium oxide with a little water, in a dish until the powder is uniformly dampened throughout. Then gradually incorporate the copaiba with it so that a uniform mixture results, place the dish on a water bath and heat during half an hour, frequently stirring. Lastly, transfer the mixture to a suitable vessel, and set it aside until the mass has acquired a pilular consistence.

Uses.—Similar to copaiba; dose, fifteen grains (1 Gm.).

SANTALUM ALBUM. N. F. **Sandal Wood**

[**Santal. Alb.**—WHITE SANDAL WOOD]

The heart wood of *Santalum album* Linné (Fam. *Santalaceæ*). It contains a volatile oil (see *Oleum Santali*).

Official Description.—In billets, pieces or chips of varying shapes and sizes, heavy, hard but splitting easily, color light yellow; transverse sections yellow to light reddish-brown, with alternating light and dark concentric zones nearly equal in diameter, with numerous pores and traversed by many very narrow medullary rays.

When examined under the microscope, sections show the medullary rays from two to four rows wide, the cells thick-walled and radially marked; the wood wedges consisting largely of wood fibers with pointed ends, large parenchyma and thick-walled secretion vessels and cells containing single crystals of calcium oxalate; the oil in globules adhering to the walls of the ducts and parenchyma cells and especially rich in the medullary cells.

Odor and Taste.—Odor characteristic, aromatic, persistent; taste peculiar, strongly aromatic.

Tests for Identity and Purity.—Sandal Wood yields not more than 8 per cent. of ash.

N. F. Preparation.—Tinctura Sabal et Santali.

Uses.—Used as a perfume, especially in sachet powders and as a stimulating diuretic.

OLEUM SANTALI. U. S. **Oil of Santal**

[**Ol. Santal.**—SANTALWOOD OIL OIL OF SANDALWOOD]

A volatile oil distilled from the wood of *Santalum album* Linné (Fam. *Santalaceæ*), yielding not less than 90 per cent. of alcohols, calculated as santalol [$C_{15}H_{26}O = 222.21$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

Official Description.—A pale yellow, somewhat thick liquid.

Odor and Taste.—Characteristic odor and taste of sandalwood.

Solubility.—Soluble in 5 volumes of 70 per cent. alcohol, forming a solution which is slightly acid to litmus.

Specific Gravity.—0.965 to 0.980 at 25° C. (77° F.).

Test for Identity and Purity.—The optical rotation varies from $-15°$ to $-20°$ in a 100-mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

Assay.—Proceed as directed for menthol under *Oleum Menthæ Piperitæ*, using 10 mils of Oil of Santal. Use the following formula in calculating the percentage of santalol in place of that given for menthol under *Oleum Menthæ Piperitæ.*

$$\text{Percentage of santalol} = \frac{A \times 11.11}{B - (A \times 0.021)}$$

In which A is the result obtained by subtracting the number of mils of half-normal sulphuric acid V.S. required in the titration from the number of mils of half-normal alcoholic potassium hydroxide V.S. originally taken, and B is the weight of acetylized oil taken.

This is an oxygenated oil containing two constituents, one of which is called *santalol*, $C_{15}H_{26}O$, boiling at 310° C. (590° F.), and the other *santalal*, $C_{15}H_{24}O$, boiling at 300° C. (572° F.). Both of these are decomposed by distilling over phosphoric anhydride, the one yielding $C_{15}H_{24}$, boiling at 260° C. (500° F.), and the other $C_{15}H_{22}$, boiling at 245° C. (473° F.). Sesquiterpenes are also believed to be present in oil of santal. It is often grossly adulterated; the proportion of santalol is recognized by an official assay (see below).

Uses.—It is used as a stimulant to the mucous membranes, especially in the treatment of gonorrhœa. It is generally administered in capsules. Dose, five to fifteen minims (0.3 to 1 mil).

BUCHU. U. S. Buchu

The dried leaves of *Barosma betulina* (Thunberg) Bartling and Wendland, known in commerce as Short Buchu; or of *Barosma serratifolia* (Curtis) Willdenow, known in commerce as Long Buchu (Fam. *Rutaceæ*), without the presence or admixture of more than 10 per cent. of stems or other foreign matter.

Official Description.—Short Buchu.—Rhomboidally oval or obovate; from 9 to 25 mm. in length and from 4 to 13 mm. in breadth; summit obtuse, and recurved; margin somewhat serrate or finely dentate with an oil gland at the base of each tooth; the base more or less wedge-shaped; color varying from vivid green to yellowish-green, occasionally a few olive-gray leaves; glandular-punctate; both surfaces papillose; under surface longitudinally striate; texture coriaceous; petiole 1 mm. in length.

Odor and Taste.—Odor and taste characteristic, aromatic and mint-like.

Long Buchu.—Linear-lanceolate, from 2.5 to 4 cm. in length and from 4 to 6 mm. in breadth; summit somewhat rounded or truncate with an oil gland at the apex; margin sharply serrate and glandular; otherwise resembling Short Buchu.

Tests for Identity and Purity.—Stems in both Short and Long Buchu about 1 mm. in diameter, yellowish-green or brownish-red, cylindrical, longitudinally furrowed, with prominent leaf-scars nearly opposite to each other giving the stems a jointed character.

The yield of ash does not exceed 4 per cent.

U. S. P. Preparation.—Fluidextractum Buchu.

N. F. Preparations.—Elixir Buchu (from Fluidextract); Elixir Buchu Compositum (from Compound Fluidextract); Elixir Buchu et Potassii Acetatis (from Elixir of Buchu); Fluidextractum Buchu Compositum.

This drug owes its valuable properties to the presence of a volatile oil and resin. It also contains a bitter principle, mucilage, etc. The stearoptene *diosphenol* is colored dark green by ferric chloride.

Uses.—Buchu is used as a diuretic. Dose, thirty grains (2 Gm.).

SERPENTARIA. U. S. Serpentaria

[**Serpent.**—TEXAS SNAKEROOT VIRGINIA SNAKEROOT]

The dried rhizome and roots of *Aristolochia Serpentaria* Linné, known in commerce as Virginia Snakeroot, or of *Aristolochia reticulata* Nuttall, known in commerce as Texas Snakeroot (Fam. *Aristolochiaceæ*), without the presence or admixture of more than 10 per cent. of the stems or other foreign matter.

Official Description.—Rhizome in both commercial varieties oblique, subcylindrical, more or less curved, from 10 to 30 mm. in length and from 1 to 2 mm. in diameter; externally dark brown, upper portion with short stem-bases and from lower and lateral portions arise numerous, long, thin, nearly straight, yellowish-brown roots; fracture short; internally yellowish-white, wood with broad, excentric wedges.

Odor and Taste.—Odor terebinthinate; taste bitter, aromatic.

Tests for Identity and Purity.—Under the microscope, transverse sections of the rhizome of both commercial varieties of Serpentaria show an outer layer of epidermal cells; a cortex of from 10 to 15 rows of parenchyma; inner bark sometimes showing strongly lignified bast-fibers, either single or distributed in a more or less interrupted circle; a xylem of broad wood-wedges separated by broad medullary rays about 8 cells wide, the walls being strongly lignified and with numerous simple pores; pith excentric, composed of polygonal cells, the walls being lignified and porous. Starch in the cells of cortical parenchyma, medullary rays and pith.

The root in transverse section shows a compact, 4- to 6-rayed stele, and a large starch-bearing cortical area.

The stem in transverse section shows an interrupted circle of from 6 to 10 fibro-vascular bundles, a cortex with a prominent continuous ring of strongly lignified cells, and a few non-glandular hairs.

The powder is grayish-brown; when examined under the microscope it exhibits numerous starch grains, single and 2- to 4-compound, the individual grains being more or less spherical or plano-convex and frequently with a central cleft, from 0.003 to 0.014 mm. in diameter; lignified elements numerous, consisting of tracheæ, wood-fibers, medullary ray cells and pith cells; a few non-glandular hairs of the stem are occasionally present.

U. S. P. Preparation.—Tinctura Cinchonæ Composita.

N. F. Preparations.—Fluidextractum Serpentariæ; Tinctura Serpentariæ.

This rhizome, when fresh, contains 1 per cent. of volatile oil, a bitter principle, starch, sugar, etc. It yields its virtues to alcohol and diluted alcohol. It is an ingredient in compound tincture of cinchona.

Uses.—It is a stimulant tonic. Dose, fifteen grains (1 Gm.).

HUMULUS. U. S. Hops

[**Humul.**]

The carefully dried strobiles of *Humulus Lupulus* Linné (Fam. *Moraceæ*), bearing their glandular trichomes and without the presence or admixture of more than 2 per cent. of stems, leaves or other foreign matter. Preserve it in tightly-closed containers, protected from light.

Official Description.—Strobile ovoid-cylindrical, about 3 cm. in length, consisting of a narrow, hairy, flexuous rachis and numerous, imbricated, yellowish-green to pale brown, obliquely-ovate, membranous scales, the base of each with numerous, yellowish-brown glandular hairs, and frequently infolded on one side, enclosing a sub-globular, light brown, very glandular achene.

Odor and Taste.—Odor strong and characteristic, becoming disagreeable and valerian-like on aging; taste aromatic and bitter.

Tests for Identity and Purity.—Hops yield not more than 8 per cent. of ash.

N. F. Preparations.—Elixir Humuli (from Fluidextract); Fluidextractum Humuli; Tinctura Humuli.

Uses.—Hops owe their sedative virtues to a small quantity of volatile oil; their bitterness is due to the resin and lupulin present. Dose, thirty grains (2 Gm.).

LUPULINUM. N. F. Lupulin

(U.S.P. VIII)

[Lupul.]

The glandular trichomes separated from the strobiles of *Humulus Lupulus* Linné (Fam. *Moraceæ*). Preserve it in tightly-closed containers, protected from light.

Official Description.—A granular powder, bright yellowish-brown, having the characteristic odor and taste of hops, becoming darker in color.

Odor and Taste.—Disagreeable and valerian-like in odor on aging, when it is unfit for use.

Tests for Identity and Purity.—Under the microscope, the glandular trichomes are somewhat globular or ellipsoidal, from 0.15 to 0.2 mm. in diameter, consisting of a single layer of secreting cells assuming the form of a shallow cup, from the inner surface of which the cuticle has been separated by the secreted yellowish-brown oleoresin.

Not less than 60 per cent. of Lupulin is soluble in ether.

Lupulin yields not more than 16 per cent. of ash.

N. F. Preparations.—Fluidextractum Lupulini; Oleoresina Lupulini.

Lupulin contains 10 per cent. of volatile oil, which, on exposure, yields valeric acid, trimethylamine, a bitter principle (lupamaric acid, $C_{82}H_{50}O_7$, resin, wax, and an alkaline liquid termed *lupuline*. Alcohol and ether are the best solvents.

Uses.—As an antispasmodic and nerve sedative. Dose, five to eight grains (0.32–0.5 Gm.).

CANNABIS. U. S. Cannabis

[**Cannab.**—Cannabis Indica, U. S. P. VIII Guaza Ganjah]

The dried flowering tops of the pistillate plants of *Cannabis sativa* Linné, or of the variety *indica* Lamarch (Fam. *Moraceæ*), freed from the thicker stems and large foliage leaves and without the presence or admixture of more than 10 per cent. of fruits or other foreign matter. Cannabis, made into a fluidextract in which 100 mils represent *one hundred grammes* of the drug, when assayed biologically, produces incoördination when administered to dogs in a dose of not more than 0.03 mil of fluidextract per kilogramme of body weight

Official Description.—In dark green or greenish-brown and more or less agglutinated fragments, consisting of the short stems with their leaf-like bracts and pistillate flowers, some of the latter being replaced with more or less developed fruits; stems cylindrical, of varying length, not more than 3 mm. in diameter, longitudinally furrowed, light green to light brown, strigose-pubescent; leaves digitately compound; leaflets, when soaked in water and spread out, linear-lanceolate, nearly sessile, margin deeply serrate; bracts ovate, pubescent, each enclosing one or two pistillate flowers, or more or less developed fruits; calyx dark green, pubescent and somewhat folded around the ovary or fruit; styles two, filiform and pubescent; ovary with a single campylotropous ovule; fruit light green to light brown, broadly ellipsoidal, about 3.5 mm. in length, finely wrinkled and slightly reticulated.

Odor and Taste.—Odor agreeably aromatic; taste characteristic.

Tests for Identity and Purity.—The powder is dark green, giving a strong effervescence on the addition of dilute hydrochloric acid; numerous sharp-pointed fragments of upper portion of non-glandular hairs and fragments of bracts and leaves showing yellowish-brown laticiferous vessels, rosette aggregates of calcium oxalate from 0.005 to 0.025 mm. in diameter; non-glandular hairs unicellular, with a very slender pointed apex and a considerably enlarged base containing, usually in the lumen, some calcium carbonate; glandular hairs of two kinds, one with a short, one-celled stalk and the other with a multicellular, long, tongue-shaped stalk, the glandular portion being globular and consisting of from 8 to 16 cells, fragments of fruits with palisade-like, non-lignified sclerenchymatous cells, walls yellowish-brown, finely porous, the lumina usually containing air; tissues of embryo and endosperm with numerous oil globules and aleurone grains, the latter from 0.005 to 0.01 mm. in diameter and consisting of large crystalloids and globoids.

The yield of alcohol extractive is not less than 8 per cent. and the alcoholic solution is of a bright green color.

Cannabis yields not more than 15 per cent. of ash.

Assay.—Prepare a fluidextract and proceed as directed under Biological Assays (Chapter LXII).

U. S. P. Preparations.—Extractum Cannabis; Fluidextractum Cannabis; Tinctura Cannabis.

N. F. Preparations.—Collodium Salicylici Composita (from Fluidextract); Mistura Chlorali et Potassii Bromidi Composita (from Extract); Mistura Chloroformi et Morphinæ Composita (from Tincture).

Cannabis contains a resinous substance, *cannabinine,* volatile oil, and tetanocannabinine. Alcohol is the best solvent for the active principles. The Pharmacopœia has permitted the use of cannabis sativa, no matter where grown, provided it conforms to the biological standard. Much cannabis is now cultivated in America and in tropical countries. The standardization of the drug and all of its preparations is required.

Uses.—It is used as an anodyne and nerve stimulant. Dose, one grain (0.065 Gm.).

VALERIANA. U. S. Valerian

[Valer.]

The dried rhizome and roots of *Valeriana officinalis* Linné (Fam. *Valerianaceæ*).

Official Description.—Rhizome upright, from 2 to 4 cm. in length and from 1 to 2 cm. in diameter, usually cut longitudinally into 2 to 4 pieces; externally yellowish-brown or dark brown, upper portion with stem-bases and frequently with a short horizontal branch or stolon, and from the outer surface arise numerous, slender, brittle roots; fracture of rhizome short and horny, internally light brown, with a thick bark and narrow central cylinder.

Odor and Taste.—Odor pronounced, of valeric acid, becoming stronger upon aging; taste sweetish, camphoraceous and somewhat bitter.

Tests for Identity and Purity.—Under the microscope, transverse sections of the root of Valerian show a single epidermal layer of papillose cells, some being modified to root hairs; a hypodermal layer containing some secretion cells with suberized walls, and in which are usually numerous small, oily globules and occasionally small prismatic crystals; cortical parenchyma, the cells filled with starch, some of the cells near the hypodermis containing a few oil globules; an endodermis of thin-walled cells enclosing a central cylinder with usually 3 to 5 fibro-vascular bundles; tracheæ with simple and bordered pores. Older roots show a large pith of starch-bearing parenchyma, a secondary thickening in the fibro-vascular bundles and a periderm of a few layers of cells.

Sections of the rhizome show a thin periderm, a cortical parenchyma with scattered fibro-vascular bundles, a layer of altered cells of the endodermis, numerous, more or less twisted, collateral fibro-vascular bundles and a large pith.

The powder is light brown to grayish-brown; under the microscope it exhibits numerous starch grains, from 0.003 to 0.02 mm. in diameter, spherical, plano-convex, polygonal, 2- to 4-compound and each usually with a central cleft; tracheal fragments, the walls having simple and bordered pores or scalariform and reticulate thickenings, accompanied by narrow sclerenchymatous fibers, the walls being thin, porous, and strongly lignified: occasional fragments of epidermis with root hairs, and fragments of cork.

Valerian yields not more than 20 per cent. of ash.

U. S. P. Preparations.—Tinctura Valerianæ; Tinctura Valerianæ Ammoniata.

N. F. Preparation.—Fluidextractum Valerianæ.

Valerian contains about 1 per cent. of volatile oil, valeric acid, resin, starch, tannin, etc.; there are also present some acetic and formic acids. Alcohol and ether are good solvents for the active principles.

Uses.—It is used as a nervine. Dose, thirty grains (2 Gm.).

VIBURNUM PRUNIFOLIUM. U. S. Viburnum Prunifolium
[**Viburn. Prun.**—BLACK HAW VIBURNUM]

The dried bark of *Viburnum prunifolium* Linné or of *Viburnum Lentago* Linné (Fam. *Caprifoliaceæ*), without the presence or admixture of more than 5 per cent. of wood or other foreign matter.

Official Description.—In irregular, transversely curved or quilled pieces, from 1.5 to 6 cm. in length, and from 0.5 to 1.5 mm. in thickness; outer surface grayish-brown, or, where the outer cork has scaled off, brownish-red, longitudinally wrinkled; inner surface reddish-brown, longitudinally striated; fracture short but uneven, showing in bark which is young or of medium thickness, a dark brown cork, a brownish-red outer cortex, and a whitish inner cortex in which are numerous light yellow groups of sclerenchymatous tissues.

Odor and Taste.—Odor slight; taste distinctly bitter and somewhat astringent.

Tests for Identity and Purity.—The powder is dark brown; under the microscope it exhibits numerous large stone cells, which are often elongated, thick-walled and strongly lignified; bast-fibers few, crystals of calcium oxalate from 0.015 to 0.035 mm. in diameter, occurring mostly in rosette aggregates, occasionally in crystal fibers; monoclinic prisms of calcium oxalate few.

U. S. P. Preparations.—Extractum Viburni Prunifolii; Fluidextractum Viburni Prunifolii.

N. F. Preparation.—Elixir Viburni Prunifolii (from Fluidextract).

Viburnum contains valeric acid, a bitter, resinous principle, *viburnin*, tannin, etc. Alcohol is the best solvent for its active principles. Virbunum Opulus is official in the N. F. (see below).

Uses.—It is used like valerian, as a nervine and tonic; it has also diuretic properties. Dose, thirty grains (2 Gm.).

VIBURNUM OPULUS. N. F. Viburnum Opulus
[**Viburn. Opul.**—HIGH BUSH CRANBERRY BARK]

The dried bark of *Viburnum Opulus* Linné var. *americanum* (Miller) Aiton (Fam. *Caprifoliaceæ*), without the presence of more than 5 per cent. of wood and other foreign matter.

Its constituents are similar to those found in *Viburnum Prunifolium.* This bark is similar in appearance to the *mountain maple* (*Acer spicatum* Lam.) and for many years this bark was substituted for it.

Official Description.—In strips, or occasionally in quills or chip-like fragments, the bark attaining a thickness of 3 mm.; outer surface of the thinner pieces of a light gray color with crooked, longitudinal, purplish-brown stripes and very small brown lenticels, the thicker pieces purplish-red or occasionally blackish, except when very young, and more or less finely fissured or thinly scaly; inner surface varying in color from yellowish to rusty-brown, with very short oblique striæ, except where the outer wood layer adheres; fracture short and weak, the fractured surface mostly whitish, varying to pale brown in the inner layer, rusty brown in the outer layer, covering the green tangential layers of phelloderm.

Odor and Taste.—Odor strong and characteristic; taste mildly astringent and decidedly bitter.

Tests for Identity and Purity.—Under the microscope, sections of Viburnum Opulus show an outer corky layer of five to twenty-five rows of cells, the walls being nearly colorless, frequently thickened on the inner surface, individual cork cells from 0.015 to 0.045 mm. in radial diameter and from 0.030 to 0.075 mm. in tangential diameter; outer bark of about ten rows of cells containing a brownish-yellow, amorphous substance, small starch grains or chloroplastids; medullary rays one to two cells in width, usually not more than one-cell wide; inner bark with occasional groups of bast fibers composed of one to ten cells, the walls being very thick, non-lignified, lamellated and finely porous; adhering wood with large tracheæ having scalariform or reticulate thickenings, and being surrounded by wood fibers with thick lignified walls; starch grains, mostly in cells of parenchyma and medullary rays, either single or compound, the individual grains not exceeding 0.006 mm. in diameter; calcium oxalate in rosette aggregates, 0.015 to 0.04 mm. in diameter, numerous fragments of parenchyma cells, the lumina filled with a reddish-brown amorphous substance.

The powder of Viburnum Opulus is light grayish-brown, consisting of irregular fragments; polygonal cork cells, with thin colorless walls; parenchyma with rosette aggregates of calcium oxalate, from 0.015 to 0.04 mm. in diameter; starch grains very small and mostly in parenchyma cells; fragments of parenchyma containing a brownish-yellow amorphous substance; occasional tracheal fragments associated with lignified wood fibers, bast fibers and stone-cells.

N. F. Preparations.—Elixir Viburni Opuli Compositum (from Fluidextract); Fluidextractum Viburni Opuli; Tinctura Viburni Opuli Composita.

Uses.—It is used as an antispasmodic and in the treatment of dysmenorrhœa. The dose is twenty to sixty grains (1.3–4 Gm.).

OLEUM CHENOPODII. U. S. Oil of Chenopodium

[**Ol. Chenopod.**—Oil of American Wormseed]

A volatile oil distilled from *Chenopodium ambrosioides anthelminticum* Linné (Fam. *Chenopodiaceæ*). Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

Official Description.—A colorless or pale yellowish liquid.
Odor and Taste.—Characteristic, disagreeable odor and taste.
Solubility.—Soluble in 8 volumes of 70 per cent. alcohol.
Specific Gravity.—0.955 to 0.980 at 25° C. (77° F.).
Tests for Identity and Purity.—Its optical rotation varies between −4° and −10° in a 100 mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

This oil consists of two distinct portions, separable by distillation; one of these has the formula $C_{10}H_{16}$, and is probably limonene; the other is heavier, and possesses the formula $C_{10}H_{16}O_2$. This constitutes over 50 per cent. of the commercial oil and has been given the name *ascaridol*, which is an unstable organic oxide, decomposing with explosive violence with inorganic acids.

Uses.—It is used as an anthelmintic. It is best administered as an emulsion, first mixing the oil with twice its volume of olive oil. Its taste is so offensive to children, to whom it is almost exclusively given, in the treatment against intestinal worms, that the emulsion should be flavored with methyl salicylate, aromatic oils, or other substances. The oil has caused death in doses of half a fluidrachm. In some cases the diluted oil may be given in capsules. Dose, three minims (0.2 mil).

OLEUM JUNIPERI. U. S. Oil of Juniper

[**Ol. Junip.**—Juniper Oil Oil of Juniper Berries]

A volatile oil distilled from the ripe fruit of *Juniperus communis*, Linné (Fam. *Pinaceæ*). Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

Official Description.—A colorless or faintly green or yellow liquid.
Odor and Taste.—Characteristic odor and taste of juniper fruit.
Solubility.—Soluble in 4 volumes of alcohol with not more than a slight cloudiness.
Specific Gravity.—0.854 to 0.879 at 25° C. (77° F.).
Tests for Identity and Purity.—The optical rotation varies from 0° to −15°, in a 100 mm. tube at 25° C. (77° F.) (see U. S. P., Test No. 21, Chapter LXII).

Oil of juniper (berries) is composed essentially of two hydrocarbons, the more abundant of which, boiling at 160° C. (320° F.), has been shown by Wallace to be *pinene*, $C_{10}H_{16}$. Above 175° C. (347° F.) another oil is obtained, which seems to be *cadinene*, $C_{15}H_{24}$. It also contains a small amount of an ester to which the peculiar juniper-like odor and taste was supposed to be due, but this cannot be the case, as the odor persists after the complete saponification of the small amount of ester. *Juniper camphor* is also present, its melting point is 165° to 166° C. (329°–330.8° F.).

U. S. P. Preparations.—Spiritus Juniperi; Spiritus Juniperi Compositus.
N. F. Preparation.—Acetum Aromaticum.

Uses.—It has diuretic and stimulant properties. Dose, three minims (0.2 mil).

ARALIA. N. F. Aralia

[**Aral.**—American Spikenard Spignet]

The dried rhizome and roots of *Aralia racemosa* Linné (Fam. *Araliaceæ*), without the presence of more than 5 per cent. of adhering stem bases, or other foreign matter.

Official Description.—Rhizome of oblique growth, about 12 cm. in length and 5 cm. in thickness, somewhat flattened, tortuous, externally pale brown, somewhat annulately roughened, frequently cut longitudinally, whitish internally; nodes approximate, each with a prominent stem scar about 3 cm. in breadth; fracture fibrous; roots numerous, of varying length, from 5 to 25 mm. in thickness, usually cut longitudinally and furrowed, sometimes with transverse ridges and corky patches; light brown or purplish-brown externally, whitish and spongy or porous internally; fracture of the cortex short, of the wood short and fibrous.

Odor and Taste.—Odor aromatic; taste mucilaginous, pungent and slightly acrid.

Tests for Identity and Purity.—A transverse section of the root shows a thick bark with several zones of secretion reservoirs containing oil, a well-developed cork with one or more hypodermal layers of lignified cells, and a more or less distinctly radiate wood.

Examined microscopically, the powdered drug shows spherical or angular, single or two- or more compound starch grains, from 0.005 to 0.02 mm. in diameter, rosette aggregates of calcium oxalate from 0.03 to 0.07 mm. in diameter, tracheæ with scalariform or reticulate thickenings and simple or bordered pores, characteristic lignified cells from the hypodermis about 0.04 to 0.1 mm. in length and about one-half as broad, their walls showing simple pores (distinction from *Aralia nudicaulis*).

Aralia yields not more than 10 per cent. of ash.

N. F. Preparations.—Fluidextractum Araliæ; Syrupus Pini Strobi Compositus; Syrupus Pini Strobi Compositus cum Morphina.

The principal constituents are resin, a little volatile oil, starch, and pectin.

Uses.—A stimulant, diaphoretic and alterative. Dose, thirty grains (2 Gm.).

CANELLA. N. F. Canella

[**Canell.**]

The dried inner bark of *Canella Winterana* (Linné) Gaertner (Fam. *Canellaceæ*). It contains an acrid volatile oil, resin and a bitter extractive.

Official Description.—In quills usually from 1 to 3 dm. in length and from 1 to 4 cm. in thickness, occasionally two or three times this size, or in irregular fragments of quills, from 1.5 to 5 mm. in thickness and 2 to 3 cm. in width, the outer periderm mostly removed; outer surface light brownish-yellow or pale orange-brown, more or less scaly with a few very shallow fissures, often more or less reticulate with slight ridges; inner surface paler, somewhat smooth, but showing coarse, longitudinal striæ; fracture short and sharp, pale yellow, with an irregular, slightly darker band just inside of the center.

Odor and Taste.—Odor slight unless the bark is heated, then aromatic, resembling that of cinnamon; taste aromatic, warm, somewhat bitter and mucilaginous.

Tests for Identity and Purity.—The powdered drug is light brown to brownish-red and, when examined under the microscope, exhibits numerous, isodiametric, thick-walled stone cells about 0.075 mm. in diameter, the walls with simple or branching pores; calcium oxalate in rosette aggregates up to 0.05 mm. in diameter; starch grains simple or two- to three-compound up to 0.02 mm. in diameter; oil cells with suberized walls numerous.

Canella yields not more than 7 per cent. of ash.

N. F. Preparation.—Pulvis Aloes et Canellæ.

Uses.—A mild, aromatic tonic in doses of thirty grains (2 Gm.).

CASCARILLA. N. F. Cascarilla

[**Cascarill.**—Sweetwood Bark Sweet Bark]

The dried bark of *Croton Eluteria* (Linné) Bennett (Fam. *Euphorbiaceæ*), without the presence of more than 5 per cent. of adhering wood.

It contains tannin, a bitter principle called *cascarillin*, resin, and about 1.6 per cent. of a volatile oil, greenish-yellow in color, of a specific gravity of about 0.938.

Official Description.—In quills or curved pieces from 0.5 to 2.5 mm. in thickness, externally gray, somewhat fissured; the corky layer easily detached, more or less coated with a white lichen; the uncoated surface dull-brown, inner surface smooth; fracture short, the fractured surface having a resinous and radially striate appearance.

Odor and Taste.—Odor characteristic, strong and musk-like when the bark is burned; taste warm, aromatic and very bitter.

Tests for Identity and Purity.—The powdered drug is pale-brown and has an odor resembling that of clove. When examined under the microscope, it exhibits simple starch grains up to 0.013 mm. in diameter and occasionally two- to three-compound; calcium oxalate in monoclinic crystals or rosette aggregates up to 0.025 mm. in diameter; fragments of parenchyma tissue, some of the cells containing starch, calcium oxalate or tannin; cells filled with reddish-brown resin or yellow oil; somewhat lignified cork cells, polygonal in outline with evenly thickened, lamellated walls and irregular lumina; non-porous bast fibers, some with lignified walls, up to 0.016 mm. in diameter; tracheæ with bordered pores very few or absent.

Cascarilla yields not more than 10 per cent. of ash.

N. F. Preparation.—Vinum Aurantii Compositum.

Uses.—Aromatic and tonic in doses of thirty grains (2 Gm.)

GALANGAL. N. F. Galangal

[**Galang.**]

The dried rhizome of *Alpinia officinarum* Hance (Fam. *Zingiberaceæ*).

Official Description.—Irregularly branched, from 2 to 10 cm. in length and from 1 to 2 cm. in thickness, the branches thinner toward the base; marked with the fine annuli of the leaf bases, which are from 3 to 10 mm. apart and of lighter color than the general surface; externally reddish- or rusty-brown; internally of a lighter orange-brown; cut ends of the branches circular, with recurved margin; fracture fibrous.

Odor and Taste.—Odor aromatic and agreeable; taste hot, spicy, resembling ginger.

Tests for Identity and Purity.—The powder is reddish-brown and, when examined under the microscope, exhibits numerous simple starch grains up to 0.06 mm. in diameter, the small grains few in number, the large grains narrow-ellipsoidal, broadened at one end, sometimes truncate, frequently curved, occasionally with a lateral development, lamellæ mostly indistinct, point of origin of growth circular or a cleft in the larger end of the grain, sometimes absent; numerous yellowish oil cells and reddish resin cells; fragments of tracheæ with reticulate thickenings or simple pores; thick-walled sclerenchymatous fibers with oblique pores.

Galangal yields not more than 10 per cent. of ash.

N. F. Preparation.—Tinctura Aromatica.

It contains about 0.5 per cent. of a volatile oil, containing cineol, also a soft acrid resin, a fixed oil, and certain active principles known as *galangin*, $C_{15}H_{10}O_5$, and *galangol*.

Uses.—Employed as a stimulant, aromatic and carminative. The dose is fifteen grains (1 Gm.).

IRIS. N. F. Orris

[Orris Root]

The rhizome of *Iris florentina* Linné, *Iris germanica* Linné or *Iris pallida* Lamarck (Fam. *Iridaceæ*), freed from the roots and peeled and dried.

It contains a peculiar, fat-like volatile oil and a soft, acrid resin. The oil is known as *orris butter* and contains the ketone *irone*. It also contains a glucoside *iridin*, $C_{24}H_{26}O_{13}$.

Official Description.—In pieces of various forms and sizes, usually jointed and branched, from 5 to 10 cm. in length and from 1.5 to 3 cm. in width, rounded or flattened, with knotty enlargements; under surface shows numerous root scars, the upper with leaf scars; externally yellowish white; internally light yellow; fracture hard, rough and at times mealy, showing a narrow cortex, a distinct endodermis and a large stele with numerous fibro-vascular bundles, especially near the endodermis.

Odor and Taste.—Odor fragrant, resembling that of violet flowers; taste slightly aromatic, bitterish, somewhat irritating.

Tests for Identity and Purity.—The powder is light yellow and, when examined under the microscope, exhibits parenchyma cells of the cortex and the stele filled with characteristic starch grains, oval, rounded at one end and flattened at the other, some curved or with irregular protuberances, mostly single, from 0.02 to 0.05 mm. in diameter; cortical parenchyma cells irregularly polygonal, with thickened and porous walls and large intercellular spaces; endodermal cells tangentially elongated; elements of fibro-vascular bundles with tracheæ showing spiral markings and from 0.01 to 0.025 mm. in width; calcium oxalate in large prisms, up to 0.5 mm. in length and 0.03 mm. in width, in intercellular spaces and in parenchyma with suberized walls. Cork cells, sclerenchyma cells and fibers absent.

Orris yields not less than 2 per cent. nor more than 5 per cent. of ash.

N. F. Preparation.—Species Pectorales.

Uses.—Rarely employed in medicine, although it has been used as a diuretic and errhine. Largely used in perfumery and tooth preparations.

JUNIPERUS. N. F. Juniper Berries

[Junip.]

The carefully dried, ripe fruit of *Juniperus communis* Linné (Fam. *Pinaceæ*). Preserve Juniper Berries in air-tight, tin or glass containers, and reject old or insect-infested fruit.

It contains a volatile oil which is official, also about 10 per cent. of resin and a yellow coloring matter called *juniperin*.

Official Description.—Nearly globular, about 8 mm. in diameter; externally smooth, shining black-brown to purplish-black with a blue-gray bloom, at the apex a three-rayed furrow marks the cohesion of the three fleshy bracts forming the pericarp; internally loosely fleshy, greenish-brown, containing numerous large schizogenous cavities; seeds three, triangular ovate, hard, brown, with large uneven oil glands on the surface.

Odor and Taste.—Odor aromatic; taste sweet, pleasant, terebinthinate, slightly bitter.

Tests for Identity and Purity.—Sections, when examined under the microscope, exhibit a pericarp consisting of an epiderm of a single row of rounded polygonal cells filled with a brown granular substance, at the sutures of the bracts these become blunt papillæ; a hypodermis of two or three rows of brown-red, collenchymatous cells thickened at the angles; the fleshy portion (mesophyll) composed of loose irregular parenchyma with large oval canals and traversed by fibro-vascular bundles with areolated fibers; a sclerenchymatous ring of six to eight rows of very thick cells with pitted walls, many enclosing prismatic crystals of calcium oxalate; the seed-testa shows a layer of two to ten rows of stone cells with radial markings on the walls and each enclosing a polygonal crystal of calcium oxalate; endosperm and embryo rich in fat and aleurone.

Juniper Berries yield not more than 5 per cent. of ash.

N. F. Preparation.— Elixir Buchu Compositum (from Compound Fluidextract of Buchu); Elixir Potassii Acetatis et Juniperi (from Fluidextract); Fluidextractum Buchu Compositum; Fluidextractum Juniperi.

Uses.—A stimulant and diuretic in doses of one drachm (4 Gm.).

MATICO. N. F. Matico

(U.S.P. VIII)

[Matic.]

The dried leaves of *Piper angustifolium* Ruiz et Pavon (Fam. *Piperaceæ*), without the presence of more than 5 per cent. of stems, flower spikes, or other foreign matter.

Matico leaves contain about 2 per cent. of volatile oil, a pungent resin, a crystalline principle, *artanthic acid*, and tannin.

Official Description.—Usually in compressed, matted masses with leaves more or less broken; leaves sub-sessile, lanceolate, from 10 to 20 cm. in length and from 2 to 5 cm. in breadth; summit tapering and acute; base slightly unequal, cordate; margin finely crenulate; upper surface dark green, tessellated; lower surface pale green, reticulate, with, prominent, yellowish-brown midrib and veins forming small quadrangular meshes clothed with matted pubescence.

Odor and Taste.—Odor distinct, aromatic; taste pungent, pepper-like.

Tests for Identity and Purity.—Sections, when examined under the microscope, exhibit the epidermis of the upper side composed of regular polygonal cells and of the lower side of somewhat irregular and undulate cells, especially where covering the veins; numerous stomata with large neighboring cells on the lower side; the hypodermis of one row and palisade cells in two or three rows; mesophyll loose, spongy tissue; midrib in cross section oval, outer layer of thick-walled cork cells; secretion cells filled with yellow oil; upper surface with papillæ and few bristly hairs; hairs of the lower surface of two kinds, the one six to ten cells in length, pointed, bent and matted, having thick walls and striate cuticle; the other bristle hairs of one stem cell and a head cell; calcium oxalate crystals few in parenchyma tissue of the venation, in the form of raphides or monoclinic prisms.

The powder is greenish-yellow and, when examined under the microscope, exhibits the characteristic hairs, polygonal epidermal cells, and secretion cells of the leaf.

Matico yields not more than 18 per cent. of ash.

N. F. Preparation.—Fluidextractum Matico.

Uses.—It is used as a stimulant and hæmostatic in doses of one drachm (4 Gm.).

MYRICA. N. F. Bayberry Bark

The dried bark of the root of *Myrica cerifera* Linné (Fam. *Myricaceæ*), without the presence of more than 5 per cent. of adhering wood.

It contains volatile oil, an acrid resin, tannin, and *myricinic acid.*

Official Description.—In quills or quilled pieces or strips, of variable length and up to 20 mm. in breadth, the bark rarely exceeding 2 mm. in thickness; outer surface varying from dark brown to gray-brown, occasionally slightly silvery, somewhat lustrous, at least in patches, bearing occasional warts or slight transverse ridges, the periderm frequently much wrinkled; inner surface deep rusty-brown, finely short-striated and somewhat roughened; fracture short and weak, light brown in the outer player, yellowish-brown in the inner layer.

Odor and Taste.—Odor characteristic, rather disagreeable; taste astringent, mildly bitter and slightly acrid.

Tests for Identity and Purity.—The powder is reddish-brown and, when examined under the microscope, exhibits crystals of calcium oxalate in monoclinic prisms up to 0.02 mm. in diameter, or in rosette aggregates up to 0.035 mm. in diameter; numerous simple, or two- to four-compound starch grains, up to 0.012 mm. in diameter; strongly lignified, porous bast fibers with walls about 0.02 mm. in thickness, often accompanied by crystal fibers; rounded or irregular stone cells, usually in groups, with thick, lignified, lamellated, porous walls; cork cells polygonal in surface view, some with brownish walls and filled with reddish contents; fragments of parenchyma, some of the cells rich in starch; tracheæ with bordered pores from adhering wood very few or absent.

Myrica yields not more than 6 per cent. of ash.

N. F. Preparations.—Pulvis Myricæ Compositus.

Uses.—It is a sialogogue when chewed and has been used in toothache. It is an active errhine and has been employed as a tonic and astringent in doses of eight grains (0.5 Gm.).

PIMPINELLA. N. F. **Pimpinella**

[Pimpinell.—PIMPERNEL ROOT]

The dried rhizome and roots of *Pimpinella saxifraga* Linné, or *Pimpinella magna* Linné (Fam. *Umbelliferæ*).

It contains resin and a volatile oil having a disagreeable odor and a bitter, acrid taste.

Official Description.—Cylindrical or slightly tapering, from 10 to 20 cm. in length and from 1 to 1.5 cm. in diameter at the crown, frequently branching, sometimes split longitudinally or broken into pieces; the upper or rhizome portion annulate, with undeveloped stem buds and a few attached stem remains which should not be over 5 cm. in length; roots longitudinally wrinkled, slightly annulate, cortex thin, easily detached; fracture short when dry, tough and flexuous when damp; externally light yellowish-brown; internally porous; cortex broad and whitish with numerous groups of projecting radial bast-fibers and reddish-brown oleoresin cells; wood yellowish, usually with a few indistinct fibers, medullary rays interrupted, cambium zone distinct.

Odor and Taste.—Odor aromatic; taste sweetish, pungent and acrid.

Tests for Identity and Purity.—The powdered drug, when examined under the microscope, shows numerous simple or two- to four-compound starch grains, the individual grains being from 0.004 to 0.01 mm. in diameter; secretion canals from 0.05 to 0.06 mm. in diameter; tracheæ reticulate or scalariform, from 0.035 to 0.07 mm. in breadth; fibers, thin-walled, numerous, thick-walled with simple pores few (*P. magna*).

Pimpinella yields not more than 5 per cent. of ash.

N. F. Preparation.—Tinctura Pimpinellæ.

Uses.—It is said to have tonic, carminative, and diuretic effects. The dose is fifteen grains (1 Gm.).

POPULI GEMMÆ. N. F. **Balsam Poplar Buds**

[Pop. Gem.—BALM OF GILEAD BUDS]

The air-dried, closed winter leaf-buds of *Populus nigra* Linné or *Populus balsamifera* Linné (Fam. *Salicaceæ*), collected early in the spring. Preserve the buds in tightly-closed containers of glass or tin.

It contains volatile oil and resin.

Official Description.—Conical, pointed, up to 2 cm. in length and from 2 to 5 mm. in thickness, consisting of closely imbricated scales, externally brown and glossy, glutinous with fragrant resin. Odor pleasant, balsamic; taste aromatic and bitter.

N. F. Preparations.—Syrupus Pini Strobi Compositus; Syrupus Pini Strobi Compositus cum Morphina.

Uses.—A stimulating expectorant; also used in an ointment for application to sluggish sores.

SAMBUCUS. N. F. **Sambucus**

[Sambuc.—ELDER FLOWERS]

The air-dried flowers of *Sambucus canadensis* Linné or of *Sambucus nigra* Linné (Fam. *Caprifoliaceæ*), separated from the peduncles and pedicels.

It contains small amounts of volatile oil, resin, sugar, and mucilage.

Official Description.—Small, from 2 to 3 mm. in breadth, shriveled; calyx superior, five-lobed; corolla cream colored to brownish-yellow, rotate, flat or slightly campanulate, regularly five-lobed; stamens five inserted at the base of the corolla and alternating with its lobes, filaments slender, anthers oblong, yellow; pollen ellipsoidal or tetrahedral and rounded, covered with finely punctate markings and having three pores.

Odor and Taste.—Odor faintly sweet and aromatic; taste slightly bitter.

Tests for Identity and Purity.—Sambucus yields not more than 8 per cent. of ash.

N. F. Preparations.—Fluidextractum Stillingiæ Compositum; Species Laxativæ.

Uses.—It has little medicinal virtue, but is used in domestic practice in the form of infusion, ointment, or poultice.

THUJA. N. F. Thuja

[ARBOR VITÆ]

The recently dried, leafy young twigs of *Thuja occidentalis* Linné (Fam. *Pinaceæ*), with stems not over 4 mm. in diameter, and without the presence of more than 1 per cent. of foreign substances.

It contains a volatile oil, resin, tannin, *pinipicrin*, and *thujin*.

Official Description.—Twigs fan-shaped, flattened, bearing the scale-like leaves appressed in four rows; leaves of the edges boat-shaped, the intermediate flat, those at the tips of the twigs very broad, the lower elongated, all bearing conspicuous glands on the back.

Odor and Taste.—Odor strongly balsamic, aromatic and pungent; taste camphoraceous, terebinthinate, and bitter.

Test for Identity and Purity.—Thuja yields not more than 7 per cent. of ash.

N. F. Preparation.—Fluidextractum Thujæ.

Uses.—A stimulant, diuretic, and emmenagogue; dose thirty grains (2 Gm.).

Unofficial Substances Containing Volatile Oil and Resin

Alisma Water Plantain	From *Alisma plantago*, indigenous to Europe. Contains an acrid resin
Oil of Water Plantain	A pungent oil
Chenopodium American Wormseed U. S. P. 1890	The fruit of *Chenopodium ambrosioides* Linné, and variety anthelminticum Gray (Fam. *Chenopodiaceæ*) and contains a volatile oil which is official, resin and a bitter principle. Used as an anthelmintic
Cunila Dittany	From *C. Mariana*, found in the United States. It contains volatile oil and resin
Juniperus Virginiana Red Cedar	The tops of *J. virginiana*, grown in Canada and the United States. It contains volatile oil, resin, etc.
Oil of Red Cedar	Distilled from the Wood of *Juniperus virginiana*
Laserpitium White Gentian	From *L. latifolium*, found in Europe. It contains volatile oil and a bitter principle
Laurocerasus Cherry Laurel	From *Prunus laurocerasus*, found in Western Asia. It contains volatile oil, resin, etc.
Laurus Laurel	The leaves and fruit of *L. nobilis*, indigenous to the Levant. It contains volatile and fixed oils, also resin, etc.
Oil of Laurel	A pale yellow oxygenated oil, sp. gr. 0.91. The yield is about 2 per cent.
Levisticum Lovage	From *L. officinale*, found in Europe. It contains volatile oil, resins, etc.
Liatris Liatris	From different species of *Liatris*, indigenous to North America
Myrtus Myrtle	From *M. communis*, found along the Mediterranean. It contains a volatile oil, resin, etc.
Ava-Kava	An intoxicating liquid, made from the root of *Piper methysticum*
Psoralea Psoralea	From different species of *Psoralea*, found in the United States. It contains a volatile oil and resin
Ptelea Shrubby Trefoil	From *P. trifoliata*, found in North America. It contains a volatile oil and pungent resin
Ruta Graveolens Rue	The herb of *R. graveolens*
Oleum Rutæ Oil of Rue	A volatile oil from *Ruta graveolens*, Sp. gr. 0.880, more soluble in water than most volatile oils. It is methyl-nonyl-ketone, $CH_3.CO.C_9H_{19}$
Sabina, Savin, U. S. P. VIII	The tops of *Juniperus sabina* Linné (Fam. *Coniferæ*). It contains a terpene, resin and a trace of tannin. The dose is eight grains (0.5 Gm.)
Oleum Sabinæ, Oil of Savin, U. S. P. VIII	A volatile oil distilled from the fresh tops of savin. Used as a stimulant and emmenagogue and has frequently been used to produce abortion. It should never be sold except upon the order of a physician. Dose, one to five minims (0.06—0.3 mil)
Wintera Winter's Bark.	The bark of *Drimys Winteri*, grown in South America
Oil of Winter's Bark.	The yield of volatile oil is about 1½ per cent.

Official Drugs and Products Containing Volatile Oil Associated with Bitter Principle or Extractive

ARNICA. U. S. Arnica
[Arnic.—Arnica Flowers]

The dried flower heads of *Arnica montana* Linné (Fam. *Compositæ*). Arnica flowers contain a trace of volatile oil, and a bitter principle, *arnicin*, with resin, coloring matter, etc. Alcohol and water extract their virtues.

Official Description.—Consisting chiefly of the tubular and ligulate flowers, occasionally with the involucre and receptacle present; involucral bracts narrowly lanceolate, about 1 cm. in length, dark green and pubescent; receptacle slightly convex, deeply pitted and densely short-hairy; ray flowers bright yellow, the ligulate portion 2 cm. in length, more or less folded lengthwise, 3-toothed, 7- to 12-veined, pistillate; tubular flowers perfect, reddish-yellow, stamens without a tail-like appendage (distinguished from anthers in flowers of *Inula helenium* Linné, which have two bristles or long tails at the base); the achenes spindle-shaped, from 5 to 7 mm. in length, dark brown, finely striate, glandular-pubescent and surmounted by a pappus a little longer than the achene and composed of a single circle of nearly white barbellate bristles.

Odor and Taste.—Odor characteristic and agreeable; taste bitter and acrid.

Tests for Identity and Purity.—The powder is yellowish-brown; pollen grains numerous, from 0.025 to 0.035 mm. in diameter, spherical, triangular in section and spinose; non-glandular hairs of three kinds, either unicellular, 4- to 6-celled, or consisting of a pair of unicellular hairs with numerous pores on the dividing wall; glandular hairs of three kinds, either with a large unicellular stalk and a unicellular, glandular head, or with a 4-celled stalk and a unicellular, glandular head, or a stalk of a double row of 5 cells and a 2-celled, glandular head; pappus consisting of a multicellular axis with unicellular branches.

Arnica yields not more than 9 per cent. of ash.

U. S. P. Preparation.—Tinctura Arnicæ.

N. F. Preparation.—Fluidextractum Arnicæ.

Uses.—It is rarely used internally. Dose, fifteen grains (1 Gm.).

MATRICARIA. U. S. Matricaria
[Matricar.—German Chamomile Wild Chamomile]

The dried flower-heads of *Matricaria Chamomilla* Linné (Fam. *Compositæ*), without the presence or admixture of more than 5 per cent. of stems or foreign matter. Preserve it in tightly closed containers and guard against attack by insects.

Official Description.—Flower-heads composed of a few white ray-florets and numerous yellow disk-florets on conical, more or less hollow receptacles, the latter being from 3 to 10 mm. in breadth; disk-flowers tubular, perfect, and without a pappus; ray-flowers from 10 to 20, pistillate, corolla white, 3-toothed and 4-veined, usually reflexed; involucre hemispherical, composed of from 20 to 30 imbricated, oblanceolate, and pubescent scales; peduncles light green to brownish-green, longitudinally furrowed, more or less twisted and attaining a length of 2.5 cm.; achenes somewhat obovoid and faintly 3- to 5-ribbed; pappus none, or only a slight membranous crown.

Odor and Taste.—Odor pleasant, aromatic; taste aromatic and bitter.

Tests for Identity and Purity.—Matricaria yields not more than 13 per cent. of ash.

N. F. Preparation.—Species Emollientes.

Matricaria contains a dark blue volatile oil, which is soluble in alcohol; the bitter principle is termed *anthemic acid*.

Uses.—It is a tonic and stimulant. Dose, four drachms (16 Gm.).

GRINDELIA. U. S. Grindelia
[Grindel.]

The dried leaves and flowering tops of *Grindelia camporum* Greene, or *Grindelia cuneifolia* Nuttall, or *Grindelia squarrosa* (Pursh) Dunal (Fam. *Compositæ*), without the presence or admixture of more than 10 per cent. of stems or other foreign matter.

Official Description.—Stems with attached branches and terminated with resinous flower-buds; stems cylindrical, not exceeding 2 mm. in diameter; light yellow or rose-colored, with alternate leaf-scars, occasionally with basal portions of leaves, sometimes more or less irregularly flexuous and coated with resin, especially at the nodes; leaves usually separate and more or less broken and varying in shape when entire from oblong and lanceolate to oblanceolate-spatulate and cuneate-spatulate, from 1 to 7 cm. in length, mostly sessile or amplexicaul and more or less sharply serrate or evenly spinosely-toothed, pale yellow to yellowish-green, very resinous, somewhat coriaceous and brittle; bracts of flowering branches almost entire and usually more or less spreading; heads more or less resinous, viscid, many-flowered, either conical-urceolate or depressed-urceolate, involucres from 5 to 20 mm. in breadth, composed of numerous imbricated bracts with more or less recurved tips; ray flowers yellow, ligulate and pistillate; disk florets yellow, tubular and perfect; pappus of two or three mostly unequal linear awns about the length of the disk florets; disk achenes more or less ovoid or oblong; more or less compressed or triquetrous, and either biauriculate or broadly unidentate or with a broad truncate, corky, thickened summit.

Odor, Taste, and Reaction.—Odor balsamic; taste aromatic and bitter, resinous.

Tests for Identity and Purity.—The powder is yellowish-brown; consisting of numerous fibrous fragments made up of tissues of the stem, the most prominent being the tracheæ with annular and spiral thickenings or marked with simple or bordered pores, associated with numerous, narrow, strongly lignified wood-fibers; pith cells more or less tabular and containing a layer of protoplasm in which are embedded numerous spheroidal granules; fragments of epidermis of leaves very characterisitic and showing more or less polygonal areas containing large chloroplastids, and the large, colorless, basal cells of the multicellular glandular hairs; pollen grains spherical, about 0.035 mm. in diameter, spinose, and in section showing three pores.

U. S. P. Preparation.—Fluidextractum Grindeliæ.

Grindelia contains a volatile oil and a bitter and resinous principle.

Uses.—A mild stomachic and expectorant. The fluidextract is largely used in lotions, mixed with water (1 to 10), for the treatment of ivy or rhus poisoning. Dose, thirty grains (2 Gm.).

ERIODICTYON. U. S. Eriodictyon

[Eriodict.—Yerba Santa]

The dried leaves of *Eriodictyon californicum* (Hooker and Arnott) Greene (Fam. *Hydrophyllaceæ*), without the presence or admixture of more than 5 per cent. of stems or other foreign matter.

Official Description.—Usually in fragments; when entire, laminæ lanceolate, from 5 to 15 cm. in length, and from 1 to 3 cm. in breadth; summits acute; bases slightly tapering into short petioles; margins irregularly serrate or crenate-dentate; upper surfaces yellowish-brown, covered with a more or less glistening resin; under surfaces grayish or yellowish-white, conspicuously reticulate with greenish-yellow veins; minutely tomentose between the reticulations; thick, brittle.

Odor and Taste.—Odor aromatic; taste balsamic, bitter, becoming sweetish.

Tests for Identity and Purity.—Under the microscope, transverse sections of the laminæ of Eriodictyon show upon the upper surface large epidermal cells, the outer walls being very uneven, owing to indentations which appear as striations in surface view; glandular hairs numerous, with short 1-celled stalks and 6- to 8-celled glandular heads; palisade cells very narrow, from 2 to 6 rows deep, containing numerous chloroplastids; cells of dorsal-pneumatic tissue (loose mesophyll) very few; fibro-vascular tissues not strongly developed except in the midrib and more prominent veins; numerous 1-celled, much twisted, thick-walled, non-glandular hairs occurring on the lower surface between the veins.

Under the microscope, sections of the stems of Eriodictyon show the epidermis usually replaced by strongly lignified cork; cortex of from 10 to 20 rows of more or less rounded cells; bast-fibers deep-seated with thick, more or less strongly lignified walls and occurring in small groups forming a more or less interrupted circle; sieve tissues in a narrow zone; wood-wedges consisting of tracheæ with spiral thickenings, simple or bordered pores and numerous strongly lignified wood-fibers, separated by medullary rays 1-cell in width; pith very large, the walls of the cells being strongly lignified and with numerous simple pores.

U. S. P. Preparation.—Fluidextractum Eriodictyi.

N. F. Preparations.—Elixir Eriodictyi Aromaticum (from Fluidextract); Syrupus Eriodictyi Aromaticus (from Fluidextract).

Eriodictyon is also known as *mountain balm*, it contains a bitter resin, volatile oil, and extractive. Its preparations are often used to disguise the taste of quinine.

Uses.—It is given in doses of fifteen to sixty grains (1 to 4 Gm.) as a stimulating tonic.

MEZEREUM. U. S. Mezereum

[MEZEREON]

The dried bark of *Daphne Mezereum* Linné, *Daphne Gnidium* Linné or of *Daphne Laureola* Linné (Fam. *Thymeleaceæ*).

Official Description.—In flexible, tough quilled pieces or somewhat flattened strips, attaining a length of 90 cm.; from 0.3 to 1 mm. in thickness; outer surface yellowish- or olive-brown (*D. Mezereum*) or purplish-brown (*D. Gnidium*) or purplish-gray (*D. Laureola*), smooth, numerous lenticels giving a transversely striated appearance and occasionally with numerous, circular, brownish-black apothecia; outer corky layer easily separable from the middle bark which varies from light green to olive-brown and with more or less detached bast-fibers; inner surface yellowish-white, satiny lustrous, finely striate; fracture tough, fibrous, the inner bark lamellated.

Odor and Taste.—Odor very slight; taste at first slight, becoming gradually and increasingly pungent and acrid.

Tests for Identity and Purity.—Under the microscope, transverse sections of Mezereum show a rather thick cork composed of from 20 to 30 rows of cells, the outer being compressed and with yellowish-brown walls, and the inner more or less tabular with nearly colorless walls; a hypodermis of 3 to 5 rows of collenchymatous cells containing chloroplastids or a yellowish-green resinous substance; an inner bark consisting mostly of nearly colorless non-lignified bast-fibers occurring in loosely united groups, and a few starch-bearing medullary rays one cell in width.

The powder is light grayish-brown; bast-fibers numerous, from 0.4 to 3 mm. in length and about 0.015 mm. in width, frequently more or less uneven or irregularly bent and considerably attenuated at the ends, the walls being from 0.001 to 0.005 mm. in thickness, colorless, non-lignified and free from pores; fragments of yellowish-brown cork cells and starch-bearing medullary rays; starch grains relatively few, mostly spherical or elliptical, occasionally 2- to 4-compound, the individual grains from 0.003 to 0.015 mm. in diameter.

U. S. P. Preparation.—Fluidextractum Sarsaparillæ Compositum.

N. F. Preparations.—Decoctum Sarsaparillæ Compositum; Fluidextractum Mezerei; Linimentum Sinapis Compositum (from Fluidextract).

Uses.—Mezereum contains *daphnin*, $C_{15}H_{16}O_9+2H_2O$, a glucoside, associated with an acrid soft resin and oil. Alcohol is the best menstruum for extracting the activity. Mezereum is rarely given internally alone, being usually combined with other drugs, as in the official compound fluidextract of sarsaparilla. The dose is eight grains (0.5 Gm.).

ASPIDIUM. U. S. Aspidium

[MALE FERN]

The rhizome and stipes of *Dryopteris Filix-mas* (Linné) Schott, or of *Dryopteris marginalis* (Linné) Asa Gray (Fam. *Polypodiaceæ*), collected in the autumn, freed from the roots and dead portions of rhizome and stipes and dried at a temperature not exceeding 70° C. (158° F.). Preserve Aspidium in tightly closed containers and protect from light.

Official Description.—Usually with the blackish-brown outer layers removed; rhizome 1 to 3 cm. in thickness, cylindraceous and nearly straight, or curved and tapering toward one end, usually split longitudinally, roughly scarred with remains of the stipe-bases, or bearing several coarse longitudinal ridges and grooves; stipes cylindrical, 3 to 5 cm. in length, about 6 mm. in thickness, nearly straight or somewhat curved, tapering toward one end, and with occasional elongated patches of the still-adhering, blackish-brown outer layers; fracture short, pale green in the inner half, the texture rather spongy, and exhibiting, in an interrupted circle, from 6 to 12 vascular bundles, each surrounded with an endodermis.

Odor and Taste.—Odor slight; taste sweetish, astringent, bitter, acrid.

Tests for Identity and Purity.—Use only such portions as have retained their green color. Aspidium yields not more than 3 per cent. of ash.

U. S. P. Preparation.—Oleoresina Aspidii.

Aspidium contains from 2 to 4 per cent. of active, amorphous *filicic acid*, $C_{14}H_{18}O_5$, *filixtannic acid*, *filicic anhydride* (also called *crystalline filicic acid* or *filicin*), other minor principles, fixed oil, etc. The green portions of the rhizome alone are active.

Uses.—It is used as a tænifuge. Dose, one drachm (4 Gm.).

STILLINGIA. U. S. Stillingia

[**Stilling.**—Queen's Root]

The dried roots of *Stillingia sylvatica* Linné (Fam. *Euphorbiaceæ*). Preserve Stillingia in tightly closed containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects.

Official Description.—When entire, terete, unequally tapering, rarely branched, usually in pieces attaining a length of 40 cm. and from 0.5 to 3 cm. in diameter, externally reddish-brown, longitudinally wrinkled; fracture very fibrous; internally the bark is light reddish-brown, thick, spongy, finely fibrous, with numerous resin cells and easily separable from the porous, radiate wood.

Odor and Taste.—Odor distinct; taste bitter, acrid and pungent.

Tests for Identity and Purity.—The powder is pinkish-brown or light reddish-brown; when examined under the microscope it exhibits numerous starch grains from 0.005 to 0.035 mm. in diameter, mostly single, very variable in shape, and usually with a central cleft; numerous fragments, with more or less tabular secretion cells, containing a reddish-brown, amorphous, resinous substance; fragments of tracheæ mostly with simple pores and associated with wood-fibers, the walls being very thin, lignified and possessing numerous, transverse, slit-like simple pores; bast-fibers long, narrow, the walls thick and slightly lignified; fragments of reddish-brown cork cells; occasionally crystals of calcium oxalate in rosette aggregates about 0.035 mm. in diameter.

Stillingia yields not more than 5 per cent. of ash.

U. S. P. Preparation.—Fluidextractum Stillingiæ.

N. F. Preparations.—Elixir Corydalis Compositum (from Fluidextract); Fluidextractum Stillingiæ Compositum.

Stillingia contains an acrid resin called *sylvacrol*, starch, a volatile oil, a fixed oil, etc.

Uses.—It is used as an alterative, in doses of thirty grains (2 Gm.).

PYRETHRUM. U. S. Pyrethrum

[**Pyreth.**—Pellitory Root]

The dried root of *Anacyclus Pyrethrum* (Linné) De Candolle (Fam. *Compositæ*). Preserve Pyrethrum in tightly closed containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects.

Official Description.—Nearly cylindrical, slightly tapering, usually in pieces from 2.5 to 10 cm. in length and from 5 to 20 mm. in diameter; externally dark brown, deeply longitudinally furrowed and somewhat wrinkled, occasionally bearing short, tough, hair-like rootlets, crown more or less annulate, and occasionally tufted with coarse fibers or with long, soft-woolly, nearly straight, 1-celled hairs; fracture short; bark dark brown with 1 or 2 circular rows of resin ducts, closely adhering to the light yellow, radiate, porous wood, in the medullary rays of which occur 1 to 3 rows of resin ducts.

Odor and Taste.—Odor distinct; taste sweetish, pungent, very acrid, tingling, and producing a strong sialogogue effect.

Tests for Identity and Purity.—The powder is light to dark brown; when examined under the microscope it exhibits numerous spherical or irregular masses of inulin, the nature of which is especially seen with polarized light, and lignified fragments of the woody tissues and stone cells associated with cork; inulin in spherical granules or irregular masses, from 0.01 to 0.1 mm. in diameter, which is not affected by the addition of iodine T.S.; tracheæ with simple pores and reticulate or scalariform thickenings, usually associated with wood parenchyma and with few or no wood fibers; stone cells in groups, the cells more or less tabular in outline and with thick, yellowish porous walls; cork in yellowish-brown or dark brown fragments.

Pyrethrum yields not more than 5 per cent. of ash.

U. S. P. Preparation.—Tinctura Pyrethri.

This root contains an acrid, brown resin, containing *pelletorin*, the alkaloid *pyrethrine*, and a volatile and a fixed oil, inulin, mucilage, etc.

Uses.—It is used as a sialagogue and stimulant, in doses of fifteen to forty grains (1 to 2.6 Gm.).

XANTHOXYLUM. U. S. Xanthoxylum

[Xanthox.—PRICKLY ASH BARK]

The dried bark of *Xanthoxylum americanum* Miller, known in commerce as Northern Prickly Ash Bark, or *Xanthoxylum Clava-Herculis* Linné, known in commerce as Southern Prickly Ash Bark (Fam. *Rutaceæ*).

Northern Prickly Ash Bark.—Official Description.—In transversely curved fragments or quills, from 2 to 15 cm. in length; bark from 0.5 to 2 mm. in thickness; outer surface light gray to brownish-gray with grayish patches of foliaceous lichens bearing numerous small black apothecia; longitudinally wrinkled and with numerous whitish lenticels; the cork occasionally abraded, showing the yellowish or orange inner bark; inner surface yellowish-white, finely longitudinally striate and usually with numerous, bright, shining crystals; fracture short, uneven.

Odor and Taste.—Odor slight; taste bitter, acrid, becoming pungent.

Under the microscope, transverse sections of Northern Prickly Ash Bark show an outer corky layer consisting of from 4 to 20 rows of cells, the tangential walls being more or less thickened and lignified; a wide strata of collenchyma inside of the cork cambium composed of from 8 to 10 rows of tangentially elongated cells, with very thick walls and containing plastids; a more or less indistinct row of endodermal cells beneath which occur small groups of primary bast-fibers; the inner bark consists of numerous parenchyma cells among which are included large oil-secretion reservoirs, separated by medullary rays which are mostly one cell in width; the parenchyma cells as well as the oil-secretion reservoirs contain numerous colorless oily globules. Scrapings from either the inner or outer surface show numerous rod-shaped crystals and flat prisms, from 0.015 to 0.25 mm. in length, which polarize light with a display of bright colors.

Southern Prickly Ash Bark.—Official Description.—In transversely curved or irregular, oblong, flattened pieces, or in quills from 2 to 40 cm. in length, bark from 1 to 4 mm. in thickness; outer surface light gray to brownish-gray, marked by numerous large, barnacle-shaped projections of cork, from 0.5 to 3.5 cm. in thickness, otherwise with numerous grayish patches of foliaceous lichens, bearing blackish apothecia, and numerous, elliptical lenticels; inner surface light yellowish-brown to olive brown, obscurely longitudinally striate and free from crystals.

Odor and Taste.—Odor and taste as in Northern Prickly Ash Bark.

Tests for Identity and Purity.—Under the microscope, transverse sections of Southern Prickly Ash Bark show a strong development of lignified cork occurring in the form of rings, the successive layers being separated by several rows of narrow tabular cells strongly thickened on the tangential walls; beneath the cork cambium occurs a thin layer of collenchyma followed by the outer tissues of the primary cortex and consisting of small groups of rather large stone cells and occasional, scattered groups of bast-fibers and parenchyma; the inner bark consists of parenchyma, a more or less indistinct leptome or sieve tissue among which are numerous, large, light yellowish oil-secretion reservoirs, medullary rays from 1 to 2 cells in width and occasional groups of stone cells and bast-fibers; starch grains numerous, nearly spherical, from 0.002 to 0.001 mm. in diameter, and occurring in the parenchyma cells and medullary rays; calcium oxalate chiefly in monoclinic prisms from 0.01 to 0.025 mm. in diameter, occurring in crystal fibers and in parenchyma cells of the primary cortex.

Powdered Xanthoxylum is light grayish-brown; under the microscope it shows mostly irregular fragments of cork cells, nearly colorless and strongly lignified, fragments of parenchyma containing either small starch grains, oily globules or monoclinic prisms of calcium oxalate; stone cells in small groups with thick, colorless walls and containing frequently a reddish-brown substance; bast-fibers few and non-lignified. In the Northern Prickly Ash, the stone cells are usually absent, and the calcium oxalate crystals and the fragments of cork are relatively few.

U. S. P. Preparation.—Fluidextractum Xanthoxyli.
N. F. Preparation.—Elixir Corydalis Compositum.

Xanthoxylum owes its virtues to a soft resin, a crystalline resin, a bitter principle, and an acrid green oil. There are also present sugar, tannin, gum, etc.

Uses.—It is a sialagogue, stimulant, and alterative. Dose, thirty grains (2 Gm.).

SABAL. U. S. Sabal

[SAW PALMETTO BERRIES]

The partially dried, ripe fruit of *Serenoa serrulata* (Michaux) Hooker filius (Fam. *Palmæ*). Preserve Sabal in tightly closed containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects.

Official Description.—Ellipsoidal or ovoid, occasionally compressed, from 1.5 to 3 cm. in length and from 1 to 1.5 cm. in diameter; externally brownish-black to bluish-black, smooth and somewhat oily, with a few large, more or less angular depressions due to the contraction of the inner layer on drying, summit marked by the scar of the style, and the base either with a short stalk or stem-scar; epicarp and sarcocarp together forming a thin coriaceous shell enclosing a hard but thin endocarp, which is externally reddish-brown and somewhat fibrous, as is also the inner layer of the sarcocarp; inner layer of endocarp smooth, enclosing a hard, ellipsoidal or ovoid, somewhat flattened, reddish-brown seed.

Odor and Taste.—Odor pronounced, aromatic; taste sweetish, aromatic, slightly acrid.

Tests for Identity and Purity.—The powder is yellowish-brown; when examined under the microscope it exhibits large, irregular fragments; parenchyma cells of sarcocarp containing a yellowish-brown or brownish-red, amorphous substance; whitish fragments of endosperm; the walls being considerably thickened and with large pores; stone cells occasional, nearly colorless, more or less tabular or irregular in shape, about 0.125 mm. in length, walls about 0.015 mm. in thickness, and with numerous simple or branching pores.

U. S. P. Preparation.—Fluidextractum Sabal.
N. F. Preparation.—Tinctura Sabal et Santali.

Uses.—Sabal contains a volatile oil, fixed oil, resin, and an alkaloidal principle. It is used as a diuretic and tonic in doses of fifteen to thirty grains (1 to 2 Gm.).

CIMICIFUGA. U. S. **Cimicifuga**

[Cimicif.—BLACK COHOSH BLACK SNAKEROOT MACROTYS]

The dried rhizome and roots of *Cimicifuga racemosa* (Linné) Nuttall (Fam. *Ranunculaceæ*), without the presence or admixture of more than 2 per cent. of stems or foreign matter.

Official Description.—Rhizome horizontal, more or less branching, from 2 to 12 cm. in length, and from 1 to 2.5 cm. in thickness; externally dark brown, slightly annulate from circular scars of bud scale-leaves, the upper surface with numerous stout, erect or somewhat curved branches terminated by deep, cup-shaped scars, each of which usually shows a distinct radiate structure; inferior and lateral portions with numerous root-scars and a few short roots; fracture horny; internally whitish and mealy, or dark brown and waxy, bark thin, wood distinctly radiate and of about the same thickness as the pith.

Odor and Taste.—Odor slight; taste bitter and acrid.

Tests for Identity and Purity.—Roots somewhat cylindrical or obtusely quadrangular, from 1 to 3 mm. in thickness, externally dark brown, longitudinally wrinkled; fracture short; internally, bark dark brown, wood yellowish, 4- to 6-rayed.

Under the microscope, sections of the rhizome of Cimicifuga show a yellowish-brown suberized epidermis, a cortex made up of about 30 layers of starch-bearing parenchyma cells; the fibro-vascular bundles collateral, the xylem consisting of tracheæ with bordered pores, and resembling tracheids in that the ends are rather acute; wood-fibers numerous, thin-walled, strongly lignified and with simple, oblique pores, the bundles separated by starch-bearing parenchyma strands from 5 to 30 cells wide; pith cells numerous, resembling those of the cortex.

Under the microscope, sections of the root of Cimicifuga show a hairy epidermis, which becomes suberized in older roots; the cortex shows about 12 rows of starch-bearing parenchyma cells; endodermis distinct; fibro-vascular bundles 4 to 6, showing in older roots as separate collateral bundles.

The powder is light to dark brown; starch grains numerous, single or compound, the individual grains spherical or more or less polygonal, each with a somewhat central cleft, from 0.003 to 0.015 mm. in diameter; fragments showing tracheæ with bordered pores and lignified wood-fibers; irregular, yellowish-brown fragments of suberized epidermis made up of more or less tabular cells, sometimes elongated and considerably thickened.

Cimicifuga yields not more than 10 per cent. of ash.

U. S. P. Preparations.—Extractum Cimicifugæ; Fluidextractum Cimicifugæ.

N. F. Preparations.—Elixir Sodii Salicylatis Compositum (from Fluidextract); Syrupus Cimicifugæ Compositus (from Fluidextract); Tinctura Cimicifugæ.

Cimicifuga contains resin, an acrid principle (possibly an alkaloid), a resinous amorphous body, starch, tannin, gum, etc.

Uses.—It is used as a sedative and alterative. Dose, fifteen grains (1 Gm.).

LACTUCARIUM. U. S. **Lactucarium**

[Lactucar.]

The dried milk-juice of *Lactuca virosa* (Fam. *Compositæ*).

Official Description.—Usually in quarter sections of hemispherical masses, or in irregular, angular pieces; externally dull reddish- or grayish-brown; fracture tough, waxy; internally light brown or yellowish, somewhat porous.

Odor and Taste.—Odor distinctive, opium-like; taste bitter.

Solubility.—Partly soluble in alcohol and ether and, when triturated with water, it yields a turbid mixture.

Tests for Identity and Purity.—*Starch.*—Treat Lactucarium with boiling water and filter; the filtrate is clear while hot; on cooling it becomes turbid but clears upon the addition of ammonia water or alcohol; it is not colored blue by iodine T.S.

Tannin.—An alcoholic solution of Lactucarium gives not more than a faint green color upon the addition of a drop of ferric chloride T.S.

The powder is grayish-brown to dark brown, consisting almost entirely of irregular fragments without any cellular structure; when mounted in hydrated chloral T.S., the fragments become clear, showing granular fragments, and from this deposit numerous rod-shaped crystals and broad monoclinic prisms as well as aggregates of these, all of which polarize light.

In the preparation of powdered Lactucarium, dry the crude drug at a temperature not exceeding 70° C. (158° F.).

Lactucarium contains not more than 15 per cent. of moisture, and yields not more than 10 per cent. of ash.

U. S. P. Preparations.—Syrupus Lactucarii (from Tincture); Tinctura Lactucarii.

Lactucarium is a complex substance. It contains a bitter resinous principle, *lactucin*, $C_{11}H_{12}O_3.H_2O$, *lactucic acid* (bitter and crystalline), *lactucopicrin* (bitter and amorphous), *lactucerin* or *lactucon* in large quantity, nearly 60 per cent. (this principle is inert and crystallizable), caoutchouc, resin, asparagin, volatile oil, mucilage, etc.

Uses.—It is used as a sedative, in doses of fifteen grains (1 Gm.).

ABSINTHIUM. N. F. Absinthium

[**Absinth.**—WORMWOOD]

The dried leaves and flowering tops of *Artemisia Absinthium* Linné (Fam. *Compositæ*), without the presence of more than 5 per cent. of foreign matter.

Official Description.—Stems and leaves gray-green, finely silky-hairy and glandular throughout; largest leaves reaching 10 or 12 cm. in length and of nearly equal breadth, on long petioles, two to three times pinnately lobed or divided, the ultimate segments oblong or obovate, obtuse, entirely or slight toothed; upper leaves becoming shorter petioled, small and narrower, the uppermost being only about 2 cm. in length and resembling the ultimate segments of the larger ones; heads racemose-paniculate, drooping on short peduncles, greenish-yellow, from 3 to 4 mm. in breadth, round-ovoid, the outer bracts linear-oblanceolate, obtuse, the inner broader and scarious-margined; receptacle hairy; outer flowers sometimes pistillate.

Odor and Taste.—Odor characteristic, aromatic; taste very bitter.

Tests for Identity and Purity.—The powdered drug is brownish to yellowish-green and, when examined under the microscope, exhibits numerous, characteristic, T-shaped, non-lignified hairs, consisting of a short, one- to four-celled stalk bearing a single apical cell attached near the center and up to 0.8 mm. in length and 0.035 mm. in width. Many of the hairs are more or less collapsed, twisted or broken; glandular hairs, some with one- or two-celled stalk, the glandular portions consisting of from four to eight secreting cells surrounded by a membrane; few simple hairs from the flowers, some of which are very long and up to 0.085 mm. in width; epidermal fragments with elliptical stomata the latter up to 0.035 mm. in length; fragments of mesophyll and palisade cells containing chloroplastids; tracheæ mostly spiral, up to 0.035 mm. in width; few sclerenchymatous fibers, with thick, usually lignified walls and simple pores, up to 0.02 mm. in width; pollen grains few, somewhat spherical or triangular in outline, up to 0.03 mm. in diameter; calcium oxalate crystals in rosette aggregates about 0.01 mm. in diameter.

Absinthium yields not more than 10 per cent. of ash.

N. F. Preparation.—Vinum Aurantii Compositum.

It contains 1 per cent. or more of a volatile oil, bitter and disagreeable in taste, containing *thujone*, $C_{10}H_{16}O$, phellandrene, and small amounts of other constituents. The drug also contains a glucoside, *absinthin*, $C_{15}H_{20}O_4$.

Uses.—A tonic; at one time used as an anthelmintic. A narcotic poison in over doses. Dose, thirty grains (2 Gm.).

APOCYNUM. N. F. Apocynum

(U.S.P. VIII)

[Apocyn.—CANADIAN HEMP]

The dried rhizome and roots of *Apocynum cannabinum* Linné (Fam. *Apocynaceœ*), without the presence of more than 5 per cent. of stems or other foreign matter.

Official Description.—Cylindrical, somewhat branched, of varying length, from 3 to 10 mm. in thickness; externally reddish-brown to grayish-brown, longitudinally wrinkled and occasionally with transverse fissures having vertical sides extending through the bark; fracture short; internally, bark light brown, from 1.5 to 3 mm. in thickness, wood faintly radiate and with large tracheæ, a small pith occurring in pieces of the rhizome.

Odor and Taste.—Almost inodorous; taste starchy, afterwards becoming bitter and somewhat acrid.

Tests for Identity and Purity.—Under the microscope sections of Apocynum show numerous laticiferous vessels in both the bark and pith.

The stems of Apocynum have a comparatively thin fibrous bark, a light brown porous wood and a large, hollow pith.

The powder is light brown, starch grains numerous, from 0.003 to 0.015 mm. in diameter, spherical, ellipsoidal, ovate, pyriform, or more or less irregular, sometimes more or less altered, swollen, and with a hyaline central cleft; numerous fragments of strongly lignified wood fibers, associated with tracheæ mostly having bordered pores, occasionally with spiral thickenings; fragments of cork layer few, the walls being of a reddish-brown color; an occasional fragment with laticiferous tissues; stone cells few or absent (*Apocynum androsaemifolium* Linné).

Apocynum yields not more than 5 per cent. of ash.

N. F. Preparation.—Fluidextractum Apocyni.

Apocynum contains a volatile oil and a resin, but the chief constituents are *cynotoxin*, an amaroid, and the bitter glucosides, *apocynin*, *apocynein*, also bitter extractive, tannin, etc.

Uses.—It is used as an emetic and antiperiodic. Dose, five to twenty grains (0.32 to 1.3 Gm.).

CAUTION.—It has been stated that the absorption of Apocynum in the gastro-intestinal tract is uncertain and irregular. To avoid an accumulation of the drug or toxic action, the physician should carefully guard the dosage and determine in each case the tolerance of the patient.

ASCLEPIAS. N. F. Asclepias

[Asclep.—PLEURISY ROOT]

The dried roots of *Asclepias tuberosa* Linné (Fam. *Asclepiadaceœ*)' without the presence of more than 5 per cent. of foreign matter.

Official Description.—Usually cut or broken pieces, of variable size, of an irregularly fusiform root, which, when entire, is from 10 to 20 cm. in length and from 0.5 to 5 cm. in thickness; occasionally branched; externally pale orange-brown, becoming grayish-brown, annulate above, the surface roughened by numerous fine intersecting grooves; bark thin; fracture tough, the broken surface granular and white, with inconspicuous pale yellow wood bundles and large white medullary rays.

Odor and Taste.—Odor slight; taste bitterish and disagreeable, somewhat acrid.

Tests for Identity and Purity.—The powdered drug is yellowish-brown and, when examined with the microscope, shows numerous simple or two- to four-compound starch grains, the individual grains up to 0.015 mm. in diameter, somewhat spherical in shape, or truncate and often with a cleft at center; calcium oxalate crystals in rosette aggregates up to 0.04 mm. in diameter; strongly lignified thick-walled stone cells up to 0.075 mm.

in diameter and with simple or branching pores; tracheæ with reticulate markings, occasionally bordered pores; spindle-shaped sclerenchyma fibers few, lignified and mostly with simple pores.

Asclepias yields not more than 9 per cent. of ash.

It contains a principle *asclepiadin*, an amorphous glucoside, also *asclepin*, and a volatile oil.

Uses.—It is used as a diaphoretic, emetic, and cathartic. Dose, thirty grains (2 Gm.).

BOLDO. N. F. Boldo

[BOLDO LEAVES]

The leaves of *Boldu Boldus* (Molina) Lyons (Fam. *Monimiaceæ*), without the presence of more than 2 per cent. of stems or other foreign matter.

Official Description.—Broadly ovate or oval, from 3 to 7 cm. in length and from 1 to 4 cm. in breadth, the base varying from rounded to very slightly indented, the summit rounded or slightly notched, the margin entire and sharply revolute; thick, coriaceous, rigid and brittle; from pale-green to brownish-green, papillose, roughened on both surfaces, the principal veins coarsely reticulate, impressed above, sharply prominent underneath; the petiole stout and rigid, from 1 to 5 mm. in length, reticulate.

Odor and Taste.—Odor peculiar; when crushed very strong, disagreeable, and somewhat like that of oil of chenopodium; taste bitter, warm and pungent, camphoraceous and slightly terebinthinate.

Tests for Identity and Purity.—Under the microscope a transverse section shows a well-marked hypodermis from which develop papilla-like excrescences, each crowned with a group of radiating, one-celled, thick-walled hairs; on the lower surface stomata numerous and hairs somewhat smaller, mesophyll with numerous oil secretion cells.

Boldo yields not more than 10 per cent. of ash.

N. F. Preparation.—Fluidextractum Boldi.

It contains volatile oil, tannin, and aromatic resinous compounds. It also contains a small amount of an alkaloid called *boldine*.

Uses.—A nerve sedative, also employed as a tonic and hepatic stimulant. Dose eight grains (0.5 Gm.). *Boldine* is used as a local anæsthetic, said to be equal to cocaine.

CALENDULA. N. F. Calendula

(U.S.P. VIII)

[Calend.—MARIGOLD]

The dried ligulate florets of *Calendula officinalis* Linné (Fam. *Compositæ*), without the presence of more than 2 per cent. of other parts of the plant or other foreign matter.

Official Description.—Florets from 15 to 25 mm. in length, yellow- or orange-colored, one- to three-toothed, four- or five-veined, margin nearly entire, the short hairy tube occasionally enclosing the remnants of a filiform style and bifid stigma.

Odor and Taste.—Odor slight, somewhat heavy; taste slightly bitter, faintly saline.

Tests for Identity and Purity.—The powdered drug is light yellow to orange-yellow, and, when examined under the microscope, exhibits a few characteristic, non-glandular hairs, consisting of a double row of thin-walled, more or less collapsed cells, with a one- or two-celled summit, and up to about 0.8 mm. in length; elongated epidermal cells with thin, somewhat wavy walls, a striated surface, and containing irregular chromoplasts and oil-like globules, the latter coalescing when mounted in hydrated chloral T.S.; pollen grains, more or less spherical, with numerous spinose projections, three-pored, and up to 0.04 mm. in diameter; tracheæ about 0.009 mm. in width with spiral and annular markings; prisms or rosette aggregates of calcium oxalate from 0.002 to 0.004 mm. in diameter.

Calendula yields not more than 11 per cent. of ash.

N. F. Preparations.—Fluidextractum Calendulæ; Tinctura Calendulæ.

Calendula contains a small quantity of a volatile oil, a bitter principle, gum, sugar, etc. *Calendulin* is not the active principle, having very little taste.

Uses.—A stimulant, antispasmodic and emmenagogue. Dose, fifteen grains (1 Gm.).

CYPRIPEDIUM. N. F. Cypripedium

(U.S.P. VIII)

[Cypriped.—LADY SLIPPER ROOT]

The dried rhizome and roots of *Cypripedium hirsutum* Miller, *Cypripedium pubescens* Willdenow, or of *Cypripedium parviflorum* Salisbury (Fam. *Orchidaceæ*), without the presence of more than 5 per cent. of other parts of the same plants or other foreign matter.

Official Description.—Rhizome of horizontal growth, curved, from 3 to 10 cm. in length, and from 2 to 6 mm. in thickness, orange-brown to dark-brown, the upper side showing numerous circular, cup-shaped scars, closely covered below with simple, wiry roots, varying from 3 to 15 cm. in length; fracture of rhizome short, white, that of roots somewhat fibrous.

Odor and Taste.—Odor distinct, heavy; taste sweetish, bitter, and somewhat pungent.

Tests for Identity and Purity.—The powdered drug is yellowish-brown and, when examined under the microscope, exhibits numerous rounded or somewhat angular, simple and compound starch grains up to 0.014 mm. in diameter; calcium oxalate in raphides up to 0.065 mm. in length and occurring isolated or in bundles, occasionally imbedded in a mucilage-like plasma; tracheæ spiral, scalariform, or with simple or bordered pores; a few tracheids; sclerenchyma fibers, long, thin-walled and lignified; a few non-lignified; thick-walled fibers; fragments of epidermal tissue composed of elongated cells with reddish-brown walls; groups of thick-walled parenchyma cells with numerous simple pores.

Cypripedium yields not more than 12 per cent. of ash.

N. F. Preparation.—Fluidextractum Cypripedii.

This rhizome contains resins, an acid principle, volatile oil, tannin, starch, etc. Diluted alcohol extracts its virtues.

Uses.—It is used as a stimulant and diaphoretic. Dose, fifteen grains (1 Gm.).

DAMIANA. N. F. Damiana

[TURNERA]

The leaves of *Turnera diffusa* Willdenow or of *Turnera aphrodisiaca* Ward (Fam. *Turneraceæ*), without the presence of more than 10 per cent. of stems and other parts of the same plants or other foreign matter.

It contains a volatile oil, an amorphous principle *damianin*, tannin, soft resin, etc.

Official Description.—Obovate to lanceolate, from 10 to 25 mm. in length and from 4 to 10 mm. in width, shortly petiolate, obtuse or acute at the apex, and with a short, cuneate base; sharply two- to ten-toothed on each side; the veins ascending, generally strong, straight and simple and running to the sinuses of the teeth, but sometimes branched and sending the branches into the teeth; the upper surface smooth and pale green, the lower glabrous or with a few hairs on the ribs (*Turnera aphrodisiaca*) or densely tomentose over the entire surface (*Turnera diffusa*). Intermixed with the leaves are frequently found some reddish twigs, the young tips and buds of which are grayish with appressed pubescence (*Turnera aphrodisiaca*) or white floccose (*Turnera diffusa*), also flower buds, yellowish flowers, and globose pods.

Odor and Taste.—Odor aromatic, taste characteristic, aromatic and resinous.

Tests for Identity and Purity.—The powdered drug is light yellowish-green and, when examined under the microscope, exhibits numerous rough simple hairs, up to 0.8 mm. in length and 0.03 mm. in width at the base, with a narrow lumen usually distinct at the base only and with heavy, mostly non-lignified walls, often curved near the base so that the major portion of the hair lies nearly parallel to the surface of the stem or leaf; fragments of the epidermis from the stems composed of somewhat rectangular cells up to about 0.07 mm. in length and about one-half as broad, with square or somewhat pointed ends, with few broadly elliptical stomata about 0.03 mm. in length; sub-epidermal cells from the stem resembling those of the epidermis in shape but with lignified walls; tracheæ, spiral, up to 0.02 mm. in width, with bordered pores up to about 0.035 mm. in width; tracheids from stem few; strongly lignified, thick-walled sclerenchyma cells or fibers few; lignified pith-parenchyma with large simple pores; fragments of epidermal cells and mesophyll of leaf; the former with somewhat wavy, vertical walls and associated with stomata up to 0.024 mm. in length; numerous crystals of calcium oxalate in rosette aggregates up to 0.03 mm. in diameter and occasionally in prisms; starch grains few, simple, up to 0.005 mm. in diameter.

Damiana yields not more than 10 per cent. of ash.

N. F. Preparation.—Fluidextractum Damianæ.

Uses.—A stimulant tonic, used as a beverage, like tea, in Mexico. It has been recommended as an aphrodisiac. The dose is thirty grains (2 Gm.).

EUPATORIUM. N. F. Eupatorium

(U.S.P. VIII)

[Eupator.—THOROUGHWORT BONESET]

The dried leaves and flowering tops of *Eupatorium perfoliatum* Linné (Fam. *Compositæ*).

Official Description.—Usually more or less broken; leaves opposite, the pair united at the base, from 8 to 20 cm. in length and from 1.5 to 5 cm. in breadth, tapering regularly from near the base to an acute summit, crenate-serrate, rugosely veined, rough and bright green above, yellowish-gray-green, tomentose and resinous-dotted beneath; flower-heads small, numerous, corymbed, with a campanulate involucre of lance-linear, imbricated scales and with from ten to fifteen tubular, yellowish-white florets having a bristly pappus in a single row.

Odor and Taste.—Odor faintly aromatic; taste strongly bitter.

Test for Purity.—Eupatorium yields not more than 10 per cent. of ash.

N. F. Preparation.—Fluidextractum Eupatorii.

This plant contains a volatile oil and resin, *eupatorin*, gum, tannin, sugar, etc. Alcohol, diluted alcohol, and water extract its virtues.

Uses.—It is used as a tonic and laxative. Dose, thirty grains (2 Gm.).

HELIANTHEMUM. N. F. Helianthemum

[Helianth.—ROCK-ROSE FROST WEED]

The dried herb of *Helianthemum canadense* (Linné) Michaux (Fam. *Cistaceæ*).

It contains a volatile oil, a fixed oil, tannin, and an alkaloidal principle.

Official Description.—Stems mostly less than 5 cm. in length, branched above, terete, frequently reddish, canescent, the slender branches mostly erect; leaves very short petioled, from 1 to 3 cm. in length, and from 4 to 8 mm. in width, oblong to oblanceolate, with entire, revolute margins, green and somewhat rough on the upper surface, canescent underneath; flowers of two kinds, rarely present at the same time, the early ones mostly solitary, pedicelled, with bright yellow corolla, from 2 to 3 cm. in breadth, hairy calyx, about thirty stamens and a single three-carpelled pistil, producing an ovoid capsule, about 7 mm. in length; later flowers apetalous, clustered in the leaf-axils, nearly sessile, having but four stamens and producing a capsule about 4 mm. in length.

Odor and Taste.—Odor slightly aromatic; taste astringent and bitter.

N. F. Preparation.—Fluidextractum Helianthemi.

Uses.—A mild aromatic tonic and astringent. Dose, one drachm (4 Gm.).

INULA. N. F. Inula

[ELECAMPANE]

The dried rhizome and roots of *Inula Helenium* Linné (Fam. *Compositæ*), without the presence of more than 5 per cent. of its stem bases or other foreign matter.

It contains a volatile oil, a soft acrid resin, and a number of other constituents have been separated.

Official Description.—Rhizome usually split into longitudinal or more or less oblique pieces to which may be attached one or more of the roots; up to 8 cm. in length and 4 cm. in diameter; externally grayish-brown to dark brown, longitudinally wrinkled with occasional buds or stem scars and surmounted at the crown by a portion of the overground stem; inner or cut surface somewhat concave, the edges incurved with the overlapping bark, yellowish-brown to grayish-brown, longitudinally striate and more or less fibrous near the cambium zone; fracture short and horny; inner surface light brown and marked by numerous circular or elliptical oleoresinous canals; roots cylindrical and tapering, frequently curved or irregularly curled, up to 13 cm. in length and 1.5 cm. in diameter.

Odor and Taste.—Odor aromatic; taste acrid, bitter and pungent.

Tests for Identity and Purity.—Transverse sections under the microscope show a corky layer of from four to seven rows of broad tabular cells; a cortex of numerous parenchyma cells containing inulin in irregular or fan-shaped masses and a number of large; intercellular, oleoresinous reservoirs arranged in nearly radial rows and forming interrupted circles; woody portion consisting chiefly of parenchyma, a number of tracheæ with simple pores or reticulate thickenings and associated occasionally with a few, strongly lignified wood fibers, and oleoresinous reservoirs similar to those occurring in the bark; parenchyma cells in the pith of the rhizome large, containing less inulin than the cells of the wood and bark and separated by large intercellular spaces.

The powder is light brown; consisting chiefly of fragments of parenchyma containing inulin and small, irregular, separated masses of inulin; tracheæ with simple pores and reticulate thickenings associated occasionally with strongly lignified wood fibers; occasional reddish-brown fragments of the walls of the oleoresinous canals.

Inula yields not more than 10 per cent. of ash.

N. F. Preparations.—Pilulæ Antiperiodicæ; Pilulæ Antiperiodicæ sine Aloe; Tinctura Antiperiodica; Tinctura Antiperiodica sine Aloe.

Uses.—A diuretic, diaphoretic and expectorant in doses of ten to thirty grains (0.65-2 Gm.). Externally it has been used as a rubifacient.

IRIS VERSICOLOR. N. F. Blue Flag

[Iris Vers.]

The dried rhizome of *Iris versicolor* Linné (Fam. *Iridaceæ*), without the presence of more than 5 per cent. of the roots and leaf bases.

It contains volatile oil, an acrid resin, tannin, and possibly an alkaloid.

Official Description.—Rhizome frequently branched, up to 10 cm. in length and 2 cm. in thickness, usually cut into longitudinal pieces; outer surface grayish-brown to purplish-brown, somewhat annulate, the upper surface with markings of leaf bases, the lower with numerous root scars and remnants; fracture short, the broken surface pale purplish-brown and exhibiting a central stele with whitish fibro-vascular bundles distributed throughout, a distinct endodermis, and cortex.

Odor and Taste.—Odor slight, not distinctive; taste acrid, nauseous.

Tests for Identity and Purity.—The powder is light purplish-brown and, when examined under the microscope, exhibits numerous resin cells filled with yellow to brown resin starch grains few, or, in some specimens, abundant, simple, or two- to four-compound, the simple grains being spherical or elliptical, up to 0.022 mm. in diameter; calcium oxalate in prisms, up to 0.35 mm. in length; tracheæ with spiral or reticulate markings or with bordered pores; sclerenchymatous fibers few, lignified and with oblique pores.

Blue Flag yields not more than 7 per cent. of ash.

N. F. Preparation.—Elixir Corydalis Compositum (from Fluidextract); Fluidextractum Iridis Versicoloris; Fluidextractum Stillingiæ Compositum.

Uses.—It is used as an emetic, diuretic and cathartic, sometimes used as an hepatic stimulant.

PARACOTO. N. F. Paracoto

[Paracot.]

The dried bark of an unidentified tree indigenous to Northern Bolivia.

It contains a volatile oil, a volatile alkaloid, *propylamine*, *phenylcoumarin*, *piperonylic acid* and *cotoin*, $C_{14}H_{12}O_4$. Cotoin is obtained by extraction with ether and purified. *Dicotoin* is an impure mixture.

Official Description.—In quills, or fragments of quills, of indefinite length, usually from 3 to 6 cm. in breadth, from 5 to 15 mm. in thickness; of a deep brown color throughout, the outer surface nearly smooth, lightly, transversely fissured, and often very thinly scaly, the inner surface very coarsely striate; hard and heavy, but splitting and breaking readily, the fracture mealy in the outer layer, with an irregular resinous band, coarse splintery in the inner layer, with large, yellowish-brown bast fibers and stone cells and darker resin tissue.

Odor and Taste.—Odor strong and characteristic, nutmeg-like; taste strongly aromatic and pungent.

Test for Identity and Purity.—Paracoto yields not more than 3 per cent. of ash.

N. F. Preparations.—Fluidextractum Paracoto; Tinctura Paracoto.

Uses.—An intestinal astringent used in diarrhœa. Dose, five grains (0.32 Gm.).

PULSATILLA. N. F. Pulsatilla

[Pulsatil.—PASQUE FLOWER]

The dried herb of *Anemone Pulsatilla* Linné, *Anemone pratensis* Linné, or of *Anemone Ludoviciana* (Nuttall) Heller (Fam. *Ranunculaceæ*), without the presence of more than 5 per cent. of foreign matter.

It contains tannin, and an acrid volatile oil of which the chief constituent is a camphor which is quickly decomposed, in the presence of water, into *anemonin*, $C_{10}H_8O_4$, and *isoanemonic acid*, $C_{15}H_{14}O_7$. These are both crystalline.

Official Description.—Leaves and flowering scapes matted, silky-villous; basal leaves with petioles up to 30 cm. in length, the latter hollow, often purplish in color, the blades twice or thrice deeply three- or four-parted or pinnately cleft, the lobes linear and acute, the base of the petiole more hairy than above and frequently attached to the short rootstock; flowering scapes up to 30 cm. in length, solid in the lower portion and hollow in the upper part, with sessile, involucral dissected leaves near the flower, occasionally with remains of the dull purple hairy sepals and the dense-woolly, plumose-tailed akenes.

Odor and Taste.—Nearly odorless; taste very acrid.

Tests for Identity and Purity.—The powder, when examined under the microscope, shows numerous simple, thick-walled hairs up to 2.5 mm. in length and up to 0.02 mm. in thickness; tracheæ up to 0.03 mm. in breadth with spiral markings or with simple or bordered pores; fragments of epidermal tissue with stomata, the latter being broadly elliptical and up to 0.05 mm. in length; some epidermal cells with wavy vertical walls; calcium oxalate crystals and starch grains few or absent.

Pulsatilla yields not more than 10 per cent. of ash.

N. F. Preparation.—Tinctura Pulsatillæ.

Uses.—It has had many virtues ascribed to it, but it is not extensively used. It is said to be a diuretic, diaphoretic, expectorant and sedative. Dose, five grains (0.32 Gm.).

SENECIO. N. F. Senecio

[Life Root]

The dried overground portions of *Senecio aureus* Linné (Fam. *Compositæ*), gathered when flowering.

It contains a volatile oil, and a small amount of a bitter principle. The constituents have not been thoroughly investigated.

Official Description.—Stems from 3 to 6 dm. in length, if entire bearing a basal rosette of leaves; sparingly clothed with successively smaller leaves and bearing at the summit several yellow heads in a loose corymb, white floccose when young, but mostly glabrous when expanded, radical leaves on long, slender petioles, mostly of rounded form from 5 to 7 cm. in breadth, the base often cordate, the summit rounded, the margin crenate-dentate; stem-leaves gradually changing from the shape of the radical leaves to lyrately-pinnate, then pinnatified and sessile, and at length clasping, oblong and incised; heads slender peduncled, from 12 to 25 mm. in breadth, the lance-linear involucral scales in about two series, closely appressed, rays about ten, bright-yellow, disk flowers very numerous, small, bearing a glabrous akene and a white pappus.

Odor and Taste.—Odor characteristically aromatic; taste bitter, slightly astringent and distinctly acrid and pungent.

Test for Identity and Purity.—Senecio yields not more than 10 per cent. of ash.

N. F. Preparation.—Fluidextractum Senecionis.

Uses.—It is used as an emmenagogue and diuretic; dose, one drachm (4 Gm.).

TRILLIUM. N. F. Trillium

[**Trill.**—Beth Root]

The dried rhizome of *Trillium erectum* Linné and closely allied species of *Trillium* (Fam. *Liliaceæ*).

It contains a small amount of volatile oil, tannin, and a principle similar to saponin.

Official Description.—Rhizome oblique, globular, oblong or obconical, truncate below, terminated by a small bud surrounded by a sheath of scarious leaf bases, annulated by leaf scars and fissured by stem scars; from 0.6 to 5 cm. in length and from 0.6 to 2.5 cm. in width, more or less compressed laterally, rootlet scars in several concentric rows on the under side in the upper portions; externally yellowish to reddish-brown; internally of a pale yellow; fracture somewhat uneven with a more or less spongy appearance.

Odor and Taste.—Odor distinct; taste bitter and acrid with a sensation of warmth in the throat, and when chewed causing an increased flow of saliva.

Test for Identity and Purity.—Trillium yields not more than 5 per cent. of ash.

N. F. Preparations.—Elixir Viburni Opuli Compositum (from Fluidextract); Fluidextractum Trillii.

Uses.—It is used as an emmenagogue, emetic, and stimulating expectorant. Dose, thirty grains (2 Gm.).

XANTHOXYLI FRUCTUS. N. F. Prickly Ash Berries
[Xanthox. Fruct.]

The dried fruit of *Xanthoxylum americanum* Miller (Northern Prickly Ash) or *Xanthoxylum Clava-Herculis* Linné (Southern Prickly Ash) (Fam. *Rutaceæ*).

The constituents are similar to those found in the bark (see page 1198).

Official Description.—Capsules with short stalks (*X. americanum*) or without stalk (*X. Clava-Herculis*); when fresh, ellipsoidal, fleshy, gray-brown, when dry, dehiscent; carpels two, convex, summit short pointed; seeds one or two, oblong, black, shining, and wrinkled from drying.

Odor and Taste.—The carpels have a pungent, warm, aromatic taste and on chewing leave a tingling sensation on the tongue; when breathed upon they emit a faintly aromatic odor resembling that of citral.

Test for Identity and Purity.—Prickly Ash Berries yield not more than 7 per cent. of ash.

N. F. Preparation.—Fluidextractum Stillingiæ Compositum.

Uses.—It is a stimulant tonic; dose, fifteen grains (1 Gm.).

ZEA. N. F. Zea
(U.S.P. VIII)

[Corn Silk]

The fresh styles and stigmas of *Zea Mays* Linné (Fam. *Gramineæ*). It contains a small amount of volatile oil, also a fixed oil, resin, and *maizenic acid*, with sugar and gum.

Official Description.—In slender filaments from 10 to 20 cm. in length, and about 0.4 mm. in diameter; of a light green, purplish-red, yellow or light brown color; stigmas bifid, the segments very slender, frequently unequal and from 0.4 to 3 mm. in length. Under the microscope, the styles are seen to consist for the most part of parenchyma and two parallel, vascular bundles with narrow, spiral or annular tracheæ; the epidermal cells are rectangular, many of these being extended into multicellular hairs, the latter being from 0.2 to 0.8 mm. in length, the basal portion consisting of two to five united cells, the upper portion being usually unicellular; the cells of the hairs are rich in cytoplasm and usually contain a small, spherical nucleus; the purplish-red styles contain a purplish-red cell cap.

Impurities and Tests for Impurities.—Digest a small portion of the fresh styles and stigmas in diluted alcohol and filter; a pale purplish-red solution is produced, separate portions of which, on the addition of acids, become distinctly purplish or yellowish-red; on the addition of alkalies, green; on the addition of ferric chloride T.S., olive-green changing to greenish-brown; and on the addition of an aqueous solution of alum, bluish or purplish, the color being quite permanent.

N. F. Preparation.—Fluidextractum Zeæ.

Uses.—It is a diuretic and mild anodyne. Preparations of the fresh drug are more active than when made from the dry drug, as the volatile principles are retained. Dose, one to two drachms (4–8 Gm.).

Unofficial Volatile Oils and Drugs Containing Volatile Oil, Bitter Principle, and Extractive

Achillea Yarrow	A perennial herb of the Family *Compositæ*, *Achillea millefolium*, growing in America and Europe. It contains *achilleine*
Oleum Achilleæ Oil of Yarrow	A blue or dark green volatile oil. The yield is about $^1/_{10}$ per cent.
Anthemis U. S. P. VIII	The dried flower heads of *Anthemis nobilis* Linné (Fam. *Compositæ*), collected from cultivated plants. It contains a volatile oil and a bitter principle called *Anthemic acid*. It is used as a tonic. Dose, thirty grains (2 Gm.)

Unofficial Volatile Oils and Drugs Containing Volatile Oil, Bitter Principle, and Extractive—*Continued*

Arnicæ Radix Arnica Root. U. S. P. 1890	The rhizome and roots of *Arnica montana* Linné (Fam. *Compositæ*). It contains 1 per cent. of volatile oil, a bitter principle *arnicin*, acrid resin, etc.
Angustura Angustura Bark	The bark of *Galipea cusparia*, from the mountains near the Orinoco River
Oil of Angustura, $C_{13}H_{24}O$	The yield of oil is about ⅙ per cent.
Apocynum Androsæmifolium Dogsbane	A root which grows in New England and Canada
Artemisia Mugwort	From *Artemisia vulgaris*. It contains volatile oil, bitter principle, etc.
Bela Bael	From *Ægle marmelos*, grown in the Himalaya Mountains. It contains tannin, bitter principle, and volatile oil
Carthamus American Saffron. Safflower	Used in infusion. Made in the proportion of two drachms to a pint of boiling water
Chekan Cheken	The leaves of *Eugenia chekan*, grown in Chili. It contains volatile oil, bitter principle, chekenon, chekenin, chekenetin, and cheken-bitter. Dose of the fluidextract, one to three fluidrachms (4 to 12 mils)
Clematis Virgin's Bower	The herb from different species of *Clematis*
Erigeron Erigeron	The leaves and tops of *Erigeron canadensis*. Diuretic, tonic, astringent. Dose, in substance, one drachm (4 Gm.)
Oleum Erigerontis Oil of Erigeron (Oil of Fleabane) U. S. P. VIII	From the fresh flowering herb *Erigeron canadensis* Linné (Fam. *Compositæ*). It consists chiefly of *d-limonene* and it also contains an oxygenated portion. Used as an hæmostatic in uterine hemorrhage in a fifteen minim (1 mil) dose
Euphrasia Eyebright	*Euphrasia officinalis*, indigenous to Europe
Genista Dyers' Broom	The young branches of *Genista tinctoria*, indigenous to Asia and Europe. It contains a yellowish-green volatile oil
Geum Water Avens	The rhizome of *Geum rivale*, grown in America and Europe. It contains volatile oil and bitter principle
Gnaphalium Life-Everlasting	From different species of *Gnaphalium*, grown in North America. It contains volatile oil and bitter principle
Hypericum St. John's Wort	From *Hypericum perforatum*, grown in Europe. It contains hypericum red, volatile oil, etc.
Parthenium Feverfew	The flowering herb of *Pyrethrum parthenium*, growing in waste places in Europe. It contains volatile oil and bitter principle
Phytolaccæ Fructus Poke Berries. U. S. P. 1890	The fruit of *Phytolacca decandra* Linné (Fam. *Phytolaccaceæ*). It contains coloring matter, sugar, gum, etc. Used as an alterative
Primula Primrose	From *Primula officinalis*, indigenous to Europe and Asia. It contains a volatile oil and primulin
Ranunculus Crowfoot	From *Ranunculus bulbosus*, found in North America. It contains a golden yellow volatile oil and a bitter principle
Tanacetum Tansy. U. S. P. 1890	The leaves and tops of *Tanacetum vulgare* Linné (Fam. *Compositæ*). The bitter principle is *tanacetin*.
Teucrium Germander	From *Teucrium Marum*, indigenous to Europe. It contains volatile oil and bitter principle
Tilia Linden Flowers	From *Tilia americana*. It contains volatile oil, bitter principle, etc.

QUESTIONS ON VOLATILE OILS

Pepper—(See page 1177.) Give the Latin name. What is its synonym? Give the official definition and description. What are the constituents?
How much volatile oil, and what is its composition?
What is its principal use?
What official preparations are made from it?
What is piperine? How is it prepared?
What effect is produced upon it by alkalies in alcoholic solution?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What are its properties, and upon what do its virtues depend? For what is it used?
Cubeb—What is the Latin official name?
Give the official definition and description.
What official preparations are made from it?
What does it contain? Upon what do its virtues depend?
Is cubebin active? What effect does strong sulphuric acid have upon cubebic acid, cubebic resin, and cubebin?
What are its medicinal properties and the dose?
Oil of cubeb—What is the Latin name? Give the U. S. P. definition.
Describe odor, taste, chemical reaction, and test for identity.
What are the constituents of this oil?

What is sometimes deposited upon standing?
What are the medicinal properties of the oil and the dose?
Capsicum—What is its synonym? What is capsicum?
Give the official description.
What are its principal constituents?
What are the properties of capsaicin?
What are the medicinal properties of capsicum? and the dose?
What official preparations are made from it?
Copaiba—What are its synonyms? What is copaiba?
What is its source? What are its constituents?
What is the composition of copaivic acid?
How may it be obtained pure?
Oil of copaiba—How is it obtained? What is its specific gravity?
Describe odor, taste, and test for identity.
Of what does it consist? What is the dose?
Give description and specific gravity.
Describe appearance, odor, taste, and solubility. Give tests for identity.
How may the following impurities be detected?—Gurjun balsam, paraffin oils; fatty oils; African copaiba.
For what is copaiba used medicinally? Name the N. F. preparations.
What is the dose?
Mass of copaiba—Give the Latin title and synonym.
How is it made? What are the uses and dose?
Sandal wood—What is the synonym?
Give the N. F. definition and description.
What is its chief constituent?
Name its N. F. preparation and uses.
Oil of santal—What are its synonyms? What percentage of alcohols, calculated as santalol, should it contain? How is it obtained? What other constituent is present?
What is its specific gravity? Describe appearance, odor, taste, chemical reaction, and solubility.
Describe the assay for santalol. For what is oil of santol used medicinally?
What is the dose?
Buchu—What is its source?
Give the official description. How does "short buchu" differ from" long buchu"?
What are its constituents, and to what does it owe its valuable properties?
What stearopten does it contain, and how is this acted upon by ferric chloride?
What are its medicinal properties and dose? Name the official preparation.
Serpentaria—What is its synonym? What is the official definition?
What are its constituents? How may its virtues be extracted?
Into what official preparations does it enter? What are its medicinal uses and the dose?
Hops—What is the Latin name? What are hops? Give the official description.
To what do they owe their virtues? Name the N. F. preparations.
Lupulin—What is the Latin name? What is lupulin? Give theofficial description.
What are the constituents of lupulin?
What change takes place in the volatile oil on exposure?
What is the bitter principle and its chemical composition?
What are the best solvents for lupulin? Name the N. F. preparations. What are its uses and dose?
Cannabis—What is the Latin name? What are its synonyms?
What is its definition and description? What is the biological standard required by the U. S. P. IX? How is this carried out? What are its constituents? What is its best solvent?
What are its medicinal properties and the dose? What are its official preparations?
Valerian—Give the official definition and description. What are its constituents?
What are good solvents for its active principle?
For what is it used? What are its official preparations?
Viburnum prunifolium—What are its synonyms? What is its source? What part of the plant is used? Describe its appearance, odor, and taste.
What are its constituents?
What is the best solvent for its active principles?
What are its properties and uses? Name the official preparation.

Viburnum opulus—What is the synonym?
Give the official definition and description. What bark has often been sold for this drug?
What are its uses and the dose? Name the official preparation.
Oil of chenopodium—What is its synonym?
What is the source of oil of chenopodium?
Describe odor and taste.
Of what does it consist? For what and how is it used?
Oil of juniper—What are the synonyms? What is the official definition?
Describe odor, taste, and chemical reaction.
What is its chemical composition?
What are its medicinal properties?
What are its official preparations?
Aralia—What are its synonyms?
Give the official definition and description.
What are the constituents? Give medicinal uses and dose?
Canella—Give the N. F. definition. Describe its appearance, odor, and taste.
Name its official preparation. Give uses and dose.
Cascarilla—What are its synonyms? What constituents are present?
Describe its appearance, odor, and taste.
What N. F. does it enter? Give uses and dose.
Galangal—Give the N. F. definition and description.
What are its constituents?
Into what preparation does it enter?
Give uses and dose.
Orris—What is its Latin title and synonym?
Give the N. F. definition and description.
What are its important constituents?
What are its uses.
Juniper berries—Give the N. F. definition and description.
What constituents are present?
Name its N. F. preparations.
What are its uses and the dose?
Matico—Give definition and description. What are its constituents?
Name its N. F. preparation. What are its uses and the dose?
Bayberry bark—Give the N. F. definition and description.
What constituents are present? What are its uses and the dose?
Pimpinella—Give the synonym, definition and description.
Name the important constituents.
What preparation is official? What are its uses and the dose?
Balsam poplar buds—What is the synonym? Give definition and description.
What are its constituents? Give uses and dose.
Sambucus—What is its synonym? Give definition and description.
What are its constituents and uses?
Thuja—What is its synonym?
Give official definition and description.
What are the chief constituents? Give uses and dose.
Arnica—What is its synonym?
Give the official definition and description. What do these flowers contain?
What is the bitter principle? What are good solvents?
What are its official preparations?
Matricaria—What are its synonyms? What is its source? Give the official description.
What are its constituents? What is the name of the bitter principle?
What are its medicinal uses and the dose?
Grindelia—What is its definition and official description?
What does it contain?
What is its official preparation? Give its uses and the dose.
Eriodictyon—What are its common names?
Give the official definition and description?
What are its official preparations?
Name the most important constituents.
What are its uses and the dose?
Mezereum—What is its synonym, definition, and description?
What does it contain? What is its best solvent?

How is it generally used medicinally? What is the dose?
What is its official preparation?
Aspidium—What is its synonym? What is its definition and description?
What should be the color of the rhizome, internally? What should be the color of the powdered drug?
What are its constituents? For what is it used?
What part of the rhizome is active? What is its official preparation?
Stillingia—What is its synonym? What is the official definition and description? What does it contain?
What is the dose? What are its official preparations?
Pyrethrum—What is its synonym? What is the official definition and description?
What does it contain? What is the dose? What is the official preparation?
Xanthoxylum—What is its synonym? What is the official definition and description?
What are the distinguishing characteristics of the Northern and Southern prickly ash?
What are its constituents, and to what does it owe its virtues?
What is the dose? What are the official preparations?
Sabal—What is its synonym? Give the official definition and description. What are its constituents?
Give its medicinal uses and dose?
Cimicifuga—What are its synonyms? What is its definition? What is the official description?
What does it contain? What is the dose? What are the official preparations?
Lactucarium—Give the official definition and description.
What are its constituents? Name its official preparations.
Give the use and dose?
Absinthium—What is the synonym?
Give its constituents. What is the official description?
In what preparation is it an ingredient?
Give its uses and dose.
Apocynum—What is the synonym? What is the official definition and description?
What does it contain? What is the dose? What precaution is necessary in administering it?
Asclepias—What is the synonym?
Give the official definition and description.
What are its constituents? Give uses and dose.
Boldo—What is its synonym?
Give the official definition and description.
What are its constituents?
Give uses and dose.
Calendula—What is its synonym?
Give the official definition and description.
What are its constituents? Give uses and dose.
Cypripedium—What is the synonym?
Give the definition and description.
What are its constituents?
Give uses and dose.
Damiana—What is its synonym?
Give the official definition and description.
What are its constituents and N. F. preparation?
Give uses and dose.
Eupatorium—What are the synonyms?
Give definition and description.
What are the constituents?
Give uses and dose.
Helianthemum—What are its synonyms?
Give the official definition and description.
What are its constituents?
What is its preparation?
Give uses and dose.
Inula—What is the synonym?

Give N. F. definition and description.
What are the constituents? Name the N. F. preparations.
Give uses and dose.
Blue flag—Give the official definition and description.
What are its constituents?
Name the N. F. preparations. Give uses and dose.
Paracoto—Give definition and description.
What are its constituents?
Name its official preparations. Give use and dose.
Pulsatilla—What is the synonym?
Give the official definition and description.
What are its constituents? What preparation is official? Give uses and dose.
Senecio—What is the synonym?
Give the official definition and description.
What are its constituents? Name its official preparation.
Give uses and dose.
Trillium—What is the synonym?
Give official definition and description.
What are the constituents? Name its N. F. preparations.
What are its uses and the dose?
Prickly ash berries—What are its sources?
Give the N. F. description.
What preparation does it enter?
Give uses and dose.
Zea—What is the synonym? Give the N. F. definition and description.
Why is the fresh drug required?
What are its uses and the dose?

CHAPTER LVII

RESINS, OLEORESINS, GUM RESINS, AND BALSAMS

RESINS are natural or induced solid or semi-solid exudations from plants, characterized by being insoluble in water, mostly soluble in alcohol, uncrystallizable, and softening or melting at a moderate heat. They are usually the *oxidized terpenes* of plants, and, owing to their insolubility in water, have little taste; they are, chemically, mixed products; some of them are acids, and combine with alkalies, forming soaps, as in the case of common rosin.

Resins, when pure, are usually transparent; when they contain water, they are opaque, and no longer hard and brittle.

Natural oleoresins are mixtures of oils and resin, generally obtained by incising the trunks of the trees in which they are found, as turpentine, copaiba, etc.

Gum resins are natural mixtures of gum and resin, usually obtained as exudations from plants, as myrrh, asafetida, etc.

Balsams are resinous substances which contain benzoic, cinnamic, or an analogous acid, as balsam of tolu, balsam of Peru, etc.

The official resins, oleoresins, gum-resins, and balsams will now be considered, followed by a condensed table of unofficial allied products.

OLEUM TEREBINTHINÆ. U. S. Oil of Turpentine
[**Ol. Tereb.**—TURPENTINE OIL "SPIRITS OF TURPENTINE"]

The volatile oil distilled with water from the concrete oleoresin obtained from *Pinus palustris* Miller or from other species of *Pinus* (Fam. *Pinaceæ*). Preserve it in well-closed containers.

This important oil has the composition $C_{10}H_{16}$, and, as has been already stated, is the type of the terpenes. It is used as a solvent in pharmacy.

Official Description.—A colorless liquid.

Odor and Taste.—Characteristic odor and taste, both of which become stronger and less pleasant on aging or exposure to the air.

Solubility.—Soluble in 5 volumes of alcohol.

Specific Gravity.—0.860 to 0.870 at 25° C. (77° F.).

Tests for Identity and Purity.—Optical rotation variable.

Distil 200 mils of the Oil, at the rate of two drops per second, from a 300 mil globe flask, having the side tube 8 cm. above the bulb. Ninety per cent. of the Oil distils between 154° and 170° C. (309.2° and 338° F.), the temperature being read with the mercury column of the thermometer immersed in the vapor.

Five mils of the Oil, shaken with an equal volume of potassium hydroxide T.S., does not become darker than a light straw yellow after standing twenty-four hours.

Five mils of the Oil, evaporated in a small dish on a water bath, leaves not more than 0.1 Gm. of residue.

Fixed Oils.—Three drops of the Oil, placed on unsized, white paper, and exposed to the air, evaporates entirely without leaving a permanent stain.

Five mils of the Oil shaken vigorously with an equal volume of hydrochloric acid in a test tube, and allowed to stand for a few minutes, does not produce a brownish or greenish color.

Mineral Oil.—Into a flask of from 35 to 50 mils capacity, having a long graduated neck (cassia flask), and containing 25 mils of fuming sulphuric acid, introduce very slowly, *drop by drop*, with constant shaking 5 mils of Oil of Turpentine, keeping the temperature just below 65° C. (149° F.) by immersion in cold water during the addition of the oil, and for five minutes thereafter, in the meantime frequently agitating the mixture cautiously but vigorously. Then cool, and add sulphuric acid until the flask is filled to the upper graduation on the neck. The clear, reddish, viscous layer, which forms after the dark mass has settled for two hours, does not exceed 1 per cent. of the volume of Oil taken. A larger layer of colorless liquid with a refractive index of less than 1.5 at 20° C. (68° F.) shows the presence of mineral oil.

Caution.—The addition of the Oil of Turpentine to the fuming sulphuric acid, drop by drop, is necessary because of the violence of the reaction.

U. S. P. Preparations.—Ceratum Cantharidis; Linimentum Terebinthinæ; Oleum Terebinthinæ Rectificatum.

N. F. Preparations.—Linimentum Opii Compositum; Linimentum Terebinthinæ Aceticum; Linimentum Tiglii Compositum; Petroxolinum Sulphuratum Compositum.

Uses.—Oil of turpentine is used externally in liniments as a stimulant and counter-irritant. The rectified oil of turpentine should be used internally.

OLEUM TEREBINTHINÆ RECTIFICATUM. U. S. Rectified Oil of Turpentine

[**Ol. Tereb. Rect.**—Rectified Turpentine Oil]

***Oil of Turpentine,** *a convenient quantity.*
Solution of Sodium Hydroxide, *a sufficient quantity.*

Shake the oil of turpentine thoroughly with an equal volume of solution of sodium hydroxide and introduce the mixture into a still connected with a well-cooled condenser. Recover about three-fourths of the oil by distillation, separate the clear oil from the water, dry it by shaking with anhydrous calcium chloride, filter and preserve the product in well-stoppered, amber-colored bottles, in a cool place.

Rectified Oil of Turpentine is to be dispensed when oil of turpentine is required for internal use.

Official Description.—A colorless liquid which conforms to the properties and tests under *Oleum Terebinthinæ,* specific gravity excepted.

Specific Gravity.—0.856 to 0.865 at 25° C. (77° F.).

Tests for Identity and Purity.—Evaporate 5 mils of the Oil rapidly in a tared dish on a water bath, not more than 0.015 Gm. of residue remains.

U. S. P. Preparation.—Emulsum Olei Terebinthinæ.

Uses.—It is used as a stimulant, diuretic, and anthelmintic, and may be given in the dose of fifteen minims (1 mil). The object of this preparation is merely to provide a purer form of oil for internal use.

TEREBENUM. U. S. Terebene

[**Tereben.**]

A liquid consisting of dipentene and other hydrocarbons, obtained by the action of concentrated sulphuric acid on oil of turpentine. Preserve it in well-closed containers, protected from light.

Official Description.—A colorless, thin liquid.

Odor and Taste.—A rather agreeable, thyme-like odor, and an aromatic, somewhat terebinthinate taste.

Solubility.—One mil of Terebene dissolves in 3 mils of alcohol at 25° C. (77° F.), slightly soluble in water.

Specific Gravity.—0.860 to 0.865 at 25° C. (77° F.).

Tests for Identity and Purity.—On exposure to light and air Terebene gradually becomes resinified, and acquires an acid reaction.

It boils between 160° and 172° C. (320° and 341.6° F.).

Unaltered Oil of Turpentine.—Terebene does not redden blue litmus paper which has been moistened with alcohol. Its optical rotation does not exceed +0.3° in a 100 mm. tube at 25° C. (77° F.).

Rosin.—After the determination of the boiling point, transfer the residue remaining in the distilling flask to a dish, by means of ether, and evaporate the liquid on a water bath; any residue remaining does not exceed 1 per cent. of the original weight of Terebene taken.

Uses.—Terebene is a valuable stimulating expectorant, given in capsules or emulsion in doses of four to sixty minims (0.25 to 4 mils) during the day.

TERPINI HYDRAS. U. S. Terpin Hydrate

[Terpin. Hyd.]

The hydrate [$C_{10}H_{18}(OH)_2+H_2O=190.18$] of the dihydric alcohol terpin. Preserve it in well-closed containers, in a cool place.

Terpin hydrate is made by acting on a mixture of oil of turpentine and alcohol with nitric acid; after standing three or four days the crystals which form are purified by recrystallization.

Official Description.—Terpin Hydrate occurs as colorless, lustrous, rhombic prisms. Efflorescent in dry air.

Odor and Taste.—Nearly odorless, and having a slightly aromatic and somewhat bitter taste.

Solubility.—One Gm. of Terpin Hydrate dissolves in about 200 mils of water, 13 mils of alcohol, 135 mils of chloroform and in 140 mils of ether at 25° C. (77° F.); also in about 34 mils of boiling water, 3 mils of boiling alcohol, and in about 1 mil of boiling glacial acetic acid.

Tests for Identity and Purity.—Heated slowly to about 100° C. (212° F.), it sublimes in fine needles. When quickly heated, it melts between 115° C. and 117° C. (239° and 242.6° F.) with the loss of water. It also loses its water of crystallization slowly over sulphuric acid.

Add a few drops of sulphuric acid to a hot aqueous solution of Terpin Hydrate; the liquid becomes turbid and develops a strongly aromatic odor.

Incinerate about 2 Gm. of Terpin Hydrate; not more than 0.05 per cent. of ash remains.

Terpin Hydrate has no odor of turpentine, and its saturated, hot, aqueous solution is not acid to litmus.

N. F. Preparations.—Elixir Terpini Hydratis; Elixir Terpini Hydratis et Diacetylmorphina; Elixir Terpini Hydratis et Codeinæ.

Uses.—Terpin hydrate is used in bronchitis, in doses of two or three grains (0.13 to 0.2 Gm.).

RESINA. U. S. Rosin

[Resin.—COLOPHONY]

The residue left after distilling the volatile oil from the concrete oleoresin obtained from *Pinus palustris* Miller and from other species of *Pinus* (Fam. *Pinaceæ*).

Official Description.—It occurs in sharp, angular, translucent, amber-colored fragments, frequently covered with a yellow dust, brittle at the ordinary temperature; fracture shiny and shallow-conchoidal.

Odor, Taste, and Reaction.—Odor and taste slightly terebinthinate. Its alcoholic solution is acid to litmus.

Solubility.—Freely soluble in alcohol, ether, benzene, glacial acetic acid, or fixed or volatile oils, it is also dissolved by diluted solutions of the fixed alkali hydroxides.

Specific Gravity.—1.07 to 1.09 at 25° C. (77° F.).

Tests for Identity and Purity.—It is easily fusible and burns with a dense yellowish smoke. Incinerate about 2 Gm. of Rosin; not more than 0.05 per cent. of ash remains.

The acid number of Rosin is not less than 150 (see U. S. P., Test No. 10, Chapter LXII).

U. S. P. Preparations.—Ceratum Cantharidis; Ceratum Resinæ; Emplastrum Resinæ; Linimentum Terebinthinæ (from Rosin Cerate).

Uses.—It is used to give adhesiveness to plasters, and also in cerates and ointments.

TEREBINTHINA. N. F. Turpentine

(U.S.P. VIII)

[Terebinth.]

A concrete oleoresin obtained from *Pinus palustris* Miller and from other species of *Pinus* (Fam. *Pinaceæ*).

White turpentine contains *abietic anhydride*, which may be converted into *abietic acid*, $C_{44}H_{64}O_5$, a bitter principle, and 25 per cent. of volatile oil.

Official Description.—Turpentine occurs in yellowish, opaque masses, lighter internally, sticky and more or less glossy, brittle in the cold.

Odor, Taste, and Reaction.—Odor and taste characteristic. Its alcoholic solution is acid to litmus.

Solubility.—Freely soluble in alcohol, ether, chloroform, or glacial acetic acid.

Tests for Identity and Purity.—*Mechanical Impurities.*—Dissolve about 1 Gm. of Turpentine, accurately weighed, in 25 mils of alcohol and collect the insoluble residue, if any, on a filter which has been dried at 100° C. (212° F.) and weighed. Then wash the residue and filter with about 25 mils of alcohol and dry at 100° C. (212° F.). The weight of the residue does not exceed 2 per cent.

N. F. Preparation.—Ceratum Resinæ Compositum.

Uses.—It is used as an ingredient in compound rosin cerate and in some unofficial plasters, and is sometimes administered in pill form. Dose, fifteen to thirty grains (1 to 2 Gm.).

OLEUM PINI PUMILIONIS. U. S. Oil of Dwarf Pine Needles

[Ol. Pin. Pumil.—DWARF PINE OIL]

A volatile oil distilled from the fresh leaves of *Pinus montana* Miller (*Pinus pumilio* Haenke) (Fam. *Pinaceæ*). Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.

Official Description.—A colorless or faintly yellowish oil.

Odor and Taste.—A pleasant aromatic odor and a bitter and pungent taste.

Specific Gravity.—0.853 to 0.869 at 25° C. (77° F.).

Tests for Identity.—No portion of the Oil distils below 170° C. (338° F.).

This oil is obtained from the Tyrolese Alps and contains *l-pinene*, *l-phellandrene*, *sylvestrene*, *bromyl acetate*, and *cadinene*.

Uses.—Used locally and internally in chronic rheumatic affections, but chiefly as an inhalant in bronchial affections.

TEREBINTHINA LARICIS. N. F. Venice Turpentine

[Terebinth. Laric. LARCH TURPENTINE]

A viscid oleoresin obtained from *Larix europoea* De Candolle (Fam. *Pinaceæ*).

Official Description.—A nearly transparent, yellowish or yellowish-green, thick liquid, heavier than water.

Odor and Taste.—Distinctive odor and a bitter, characteristic taste.

Solubility.—Completely soluble in alcohol, glacial acetic acid, acetone, or chloroform. Almost entirely soluble in petroleum benzin with the separation of a light flocculent deposit.

Tests for Identity and Purity.—One part of Venice Turpentine dissolves completely and forms a clear solution in 3 parts of 80 per cent. alcohol.

Rosin Oil.—It may possess a slight, greenish fluorescence when viewed by reflected light, but exhibits no violet or purple fluorescence.

Rosin Oil.—Dissolve 5 Gm. of Venice Turpentine in 25 mils of alcohol, add a few drops of phenolphthalein T.S. and render the solution slightly alkaline by the addition of a 10 per cent. solution of potassium hydroxide. The resulting solution is clear and transparent and no separation of oily drops occurs.

Its acid number is not more than 80 when determined as directed in the U. S. P., Test No. 10, Chapter LXII).

N. F. Preparation.—Petroxolinum Terebinthinæ Laricis.

Uses.—It is used as a stimulant, diaphoretic and diuretic.

ASAFŒTIDA. U. S. Asafetida

[**Asafœt.**—Gum Asafetida]

The gum-resin obtained by incising the rhizomes and roots of *Ferula Asafœtida* Linné and *Ferula fœtida* Regel and of some other species of *Ferula* (Fam. *Umbelliferæ*), indigenous to Persia and adjacent countries and yielding not less than 60 per cent. (or if powdered 50 per cent.) of alcohol-soluble constituents.

Official Description.—In a soft mass, sometimes almost semi-liquid, or in irregular more or less pliable masses composed of agglutinated tears of variable size imbedded in a yellowish-brown or dark brown matrix, or in loose ovoid tears, from 1 to 4 cm. in diameter, the surface sometimes containing streaks of violet, yellowish-red or brownish-red and with a few vegetable fragments; when fresh the mass is either soft or tough, becoming hard and occasionally even brittle on drying; the surface of the freshly fractured tears is milky-white and opaque, changing gradually on exposure to a pinkish or reddish-purple or even reddish-brown; on moistening with water, the tears become milky-white.

Odor, Taste, and Reaction.—Odor persistent, alliaceous; taste bitter, alliaceous and acrid.

Tests for Identity and Purity.—Triturate one part of Asafetida with three parts of water; it forms a milk-white emulsion which becomes yellowish on the addition of alkalies. Heat a fragment of one of the tears of Asafetida with sulphuric acid; a reddish-brown solution is formed; greatly dilute the latter with water, filter, and add an excess of any of the alkalies; the solution acquires a blue fluorescence, which becomes more pronounced upon the addition of a slight excess of ammonia water. An alcoholic solution of Asafetida, on the addition of a few drops of phloroglucinol T.S. and a few drops of hydrochloric acid, acquires a cherry-red color.

Most Foreign Resins.—Add a few drops of ferric chloride T.S. to a portion of the alcoholic solution of Asafetida, obtained in the assay process given below; an olive-green color is produced.

Galbanum.—Add hydrochloric acid to another portion of the same alcoholic solution of Asafetida until a faint turbidity results; a bluish-green color is developed, which fades on standing.

Rosin.—Evaporate a quantity of the same alcoholic solution, representing 5 Gm. of Asafetida, to 25 mils, mix it with 25 mils of petroleum benzin, in a separatory funnel, and afterwards add to it twice its volume of water and agitate. The petroleum benzin layer, after washing with water and subsequent separation, exhibits no green color when shaken with 30 mils of a freshly made aqueous solution of copper acetate (1 in 20).

Ammoniac.—Mix 2 mils of emulsion, prepared as directed under *Emulsum asafœtidæ*, with 5 mils of water and add 5 mils of sodium hypobromite T. S., so as to form a separate layer; a red color is not produced.

The yield of ash of the gum-resin does not exceed 15 per cent.

Powdered Asafetida.—The powder is prepared by drying the gum-resin over freshly-burnt lime or by exposure to currents of warm air until it ceases to lose weight and then reducing it to a powder at a low temperature. Diluents of starch or magnesium carbonate may be added in order to maintain the powdered form. The color of powdered Asafetida is light brown.

The yield of ash of powdered Asafetida does not exceed 30 per cent.

Assay.—Introduce about 10 Gm. of Asafetida into a tared, 250 mil Erlenmeyer flask, determine the exact weight of the drug, add 100 mils of alcohol, and having connected the flask with an upright condenser, boil the mixture in the flask during one hour or until the drug is completely disintegrated. Then transfer the contents of the flask to two counterpoised, plainly folded filters one within the other, so that the triple fold of the inner filter is laid against the single side of the outer, and wash the flask and filter with consecutive, small portions of boiling alcohol until the washings no longer produce a cloudiness when dropped into water. Collect and reserve the alcoholic solutions, for the qualitative test given above. Dry the filters and flask to a constant weight at a temperature of about 115° C. (239° F.). Now determine the weight of the residue on the filter and in the flask and calculate its percentage from the amount of Asafetida originally taken. This percentage of alcohol-insoluble material, when subtracted from 100, gives the percentage of the alcohol-soluble constituents contained in the Asafetida.

U. S. P. Preparations.—Emulsum Asafœtidæ; Pilulæ Asafœtidæ; Tinctura Asafœtidæ.

N. F. Preparations.—Mistura Magnesiæ, Asafœtidæ et Opii (from Tincture); Pilulæ Aloes et Asafœtidæ.

A volatile oil is found containing sulphides in this gum resin, also about 20 per cent. of gum, and not less than 60 per cent. of resin. The gum is partially soluble in water; the resin is soluble in alcohol, and yields resorcinol by treatment with potassium hydroxide, and umbelliferone by dry distillation. The asafetida which reaches this country was grossly adulterated until the regulations of the Food and Drugs Act were enforced. It may now be obtained of good quality. The valuable principles in asafetida are soluble in alcohol; with water an emulsion may be formed, which possesses its virtues.

Uses.—It is used as an antispasmodic. Dose, four grains (0.25 Gm.).

MYRRHA. U. S. Myrrh

[**Myrrh.**—Gum Myrrh]

A gum-resin obtained from one or more species of *Commiphora* (Fam. *Burseraceæ*).

Official Description.—In rounded or irregular tears or masses, brownish-yellow or reddish-brown, and covered with a brownish-yellow dust; fracture waxy, somewhat splintery, translucent on the edges, sometimes marked with nearly white lines.

Odor and Taste.—Odor balsamic; taste aromatic; bitter and acrid.

Tests for Identity and Purity.—The powder is yellowish-brown; 0.001 Gm. of the powder, when added to a drop of fixed oil on a slide and examined under the microscope shows numerous angular fragments varying in color from pale yellow to yellowish-brown; when mounted in hydrated chloral T.S., the color of the yellowish fragments is intensified; the addition of iodine T.S. to the powder, previously mounted in hydrated chloral T.S., may show the presence of a few starch grains varying in shape from spherical, polygonal, and narrowly ellipsoidal to somewhat pear-shaped, from 0.01 to 0.035 mm. in diameter; when mounted in phloroglucinol T.S. and hydrochloric acid, the powder may show a few fragments of lignified tissues consisting of either sclerenchymatous fibers, or of small groups of stone cells, the individual cells of the latter with very thick, porous walls and from 0.015 to 0.05 mm. in length.

Not less than 35 per cent. of Myrrh is soluble in alcohol.

Myrrh yields not more than 8.5 per cent. of ash.

U. S. P. Preparations.—Pilulæ Rhei Compositæ; Tinctura Myrrhæ; Pilulæ Aloes et Myrrhæ.

N. F. Preparations.—Mistura Ferri Composita; Pilulæ Aloes, Hydrargyi et Scammonii Compositæ (from Tincture of Aloes and Myrrh); Pilulæ Antiperiodicæ; Pilulæ Antiperiodicæ sine Aloe; Tinctura Aloes et Myrrhæ; Tinctura Antiperiodica; Tinctura Antiperiodicæ sine Aloe; Tinctura Capsici et Myrrhæ.

Myrrh is a gum resin, and contains 3 per cent. of an oxygenated volatile oil, a bitter principle, and about 30 per cent. of gum and 60 per cent. of resin. Alcohol is the best solvent for the oil and resin which are its active principles. The gum left after macerating myrrh in alcohol may be used for making a good mucilage.

Uses.—It is a stimulant, and vulnerary. Dose, eight grains (0.5 Gm.).

GUAIACUM. U. S. Guaiac

[**Guaiac.**—Guaiac Resin]

The resin of the wood of *Guaiacum officinale* Linné, or of *Guaiacum sanctum* Linné (Fam. *Zygophyllaceæ*).

Official Description.—In irregular fragments or in large, nearly homogeneous masses, occasionally in more or less rounded or ovoid tears, enclosing fragments of vegetable tissues; externally brown, becoming greenish-gray-brown on exposure, the fractured surface having a glassy luster, the thin pieces being translucent and varying in color from reddish to yellowish-brown.

Odor and Taste.—Odor balsamic; taste slightly acrid.

Tests for Identity and Purity.—Guaiac melts between 85° and 90° C. (185° and 194° F.). It is readily soluble in alcohol, ether, chloroform, creosote, and in solutions of the alkalies or in hydrated chloral T.S. It is sparingly soluble in carbon disulphide or benzene and not more than 15 per cent. is insoluble in alcohol; the alcoholic solution, on the addition of an excess of chlorine water or tincture of ferric chloride, becomes blue, changing quickly to green, the color being best seen when the solutions are diluted with an equal volume of water.

Rosin.—Macerate the crushed or powdered Guaiac with 4 or 5 times its weight of purified petroleum benzin for three hours and then filter; the filtrate is colorless, and does not give a green color on the addition of an equal volume of cupric acetate T.S.

The powder is grayish, becoming green on exposure to the air.

Guaiac yields not more than 4 per cent. of ash.

U. S. P. Preparations.—Tinctura Guaiaci; Tinctura Guaiaci Ammoniata.

N. F. Preparations.—Gargarisma Guaiaci Composita; Glyceritum Guaiaci; Mistura Guaiaci (from Tincture); Pilulæ Antimonii Compositæ; Tinctura Guaiaci Composita.

This resin is usually prepared by boiling guaiac chips in salt water; the resinous scum is collected, melted, and strained. It consists of *guaiacic acid* ($C_{12}H_{16}O_6$), *guaiaconic acid* ($C_{19}H_{20}O_5$), *guaiaretic acid* ($C_{20}H_{26}O_4$), beta resin, gum, etc. Alcohol and alkaline solutions are the best solvents for guaiac. A solution of guaiac resin is colored blue by oxidizing agents, due to the presence of guaiaconic acid.

Uses.—Guaiac is used as a remedy in rheumatism in doses of fifteen grains (1 Gm.).

GUAIACI LIGNUM. N. F. Guaiac Wood

[**Guaiac. Lig.**—Lignum Vitæ]

The heart-wood of *Guaiacum officinale* Linné or of *Guaiacum sanctum* Linné (Fam. *Zygophyllaceæ*).

The chief constituent is the resin which is official in the U. S. P. (See above).

Official Description.—Usually in the form of shavings, chips or raspings of a greenish-brown color, heavier than water, entirely free from adhering bark and containing only a few chips or shavings of a whitish color (*sap wood*).

Odor and Taste.—Almost odorless except when heated; taste bitter and acrid when chewed for some time.

Tests for Identity and Purity.—The powder, when examined under the microscope exhibits numerous fragments of more or less lignified, thick-walled wood fibers, up to 0.028 mm. in width, some with simple, oblique pores; tracheæ from 0.09 to 0.16 mm. in width, some filled with resin; numerous small masses of resin; wood parenchyma and medullary ray cells up to 0.02 mm. in width, with lignified, porous walls and usually containing resin; occasionally tangential views of the medullary rays show an elliptical group of from three to six cells; the resin masses and resinous tissue become bluish-green on the addition of iodine T.S.

Place powdered Guaiac Wood in a solution of sodium chloride (1 in 3); the blackish-brown part only will sink and this does not exceed in amount the portion which floats.

Shake 10 mils of alcohol with 0.5 Gm. of ground Guaiac Wood for a few seconds and filter the mixture; the filtrate yields a deep blue color with one drop of a solution of ferric chloride (1 in 10).

Guaiac Wood yields to alcohol not less than 15 per cent. of extractive.

Guaiac Wood yields not more than 3 per cent. of ash.

N. F. Preparation.—Decoctum Sarsaparillæ Compositum.

Uses.—Same as for the resin. Dose, one drachm (4 Gm.).

BALSAMUM TOLUTANUM. U. S. Balsam of Tolu

[**Bals. Tolu.**—Tolu Balsam]

A balsam obtained from *Toluifera Balsamum* Linné (Fam. *Leguminosæ*).

Official Description.—A yellowish-brown, or brown, plastic solid, becoming brittle when old, dried, or exposed to cold. It is transparent in thin layers.

Odor, Taste, and Reaction.—A pleasant, aromatic odor, resembling that of vanilla, and a mild, aromatic taste. An alcoholic solution of the Balsam (1 in 20) is acid to litmus.

Tests for Identity and Purity.—Balsam of Tolu is nearly insoluble in water and in petroleum benzin. It is soluble in alcohol, chloroform, and ether. It is dissolved by solutions of the fixed alkalies, usually leaving an insoluble residue.

Rosin.—Shake about 1 Gm. of the Balsam with 25 mils of carbon disulphide, allow it to stand for thirty minutes, filter the liquid and evaporate 15 mils of the filtrate to dryness. The residue thus obtained, when dissolved in glacial acetic acid, does not show a green color on the addition of a few drops of sulphuric acid.

Rosin or Copaiba.—The remaining portion of the filtrate, when shaken with an equal volume of an aqueous solution of copper acetate (1 in 1000), does not acquire a green color.

Dissolve about 1 Gm. of the Balsam, accurately weighed, in 50 mils of alcohol, add 1 mil of phenolphthalein T.S. and titrate the solution with half-normal alcoholic potassium hydroxide V.S. The acid number thus obtained is not less than 112 nor more than 168. Now add sufficient half-normal alcoholic potassium hydroxide V.S. to the neutralized liquid to make the total amount of the volumetric alkali solution exactly 20 mils; heat the liquid on a water bath for half an hour, under a reflux condenser, and allow it to cool. Mix this liquid with 200 mils of distilled water, or more if necessary, and titrate the excess of potassium hydroxide with half-normal sulphuric acid V.S.; the total amount of half-normal potassium hydroxide V.S. consumed corresponds to a saponification value of not less than 154 nor more than 220 (see U. S. P., Test No. 10, Chapter LXII).

U. S. P. Preparations.—Syrupus Tolutanus (from Tincture); Tinctura Benzoini Composita; Tinctura Tolutana. It is also used as a pill coating for the following: Pilulæ Ferri Iodidi; Pilulæ Phosphori.

Balsam of tolu contains *cinnamic* and *benzoic acids,* resins, a volatile oil called *benzyl benzoate,* $C_7H_5(C_7H_7)O_2$, *benzyl cinnamate,* a terpene, $C_{10}H_{16}$, termed *tolene,* and other unimportant constituents.

Uses.—It is used as a stimulant and expectorant in doses of fifteen grains (1 Gm.); also as a pill coating to prevent oxidation.

BALSAMUM PERUVIANUM. U. S. Balsam of Peru

[**Bals. Peruv.**—Peru Balsam]

A balsam obtained from *Toluifera Pereiræ* (Royle) Baillon (Fam. *Leguminosæ*).

Official Description.—A viscid liquid of a dark brown color; free from stringiness or stickiness; transparent and reddish-brown in thin layers. Water, when agitated with the Balsam, is acid to litmus. It does not harden on exposure to the air.

Odor, Taste, and Reaction.—An agreeable vanilla-like odor and a bitter, acrid taste, with a persistent after-taste. When swallowed it leaves a burning sensation in the throat.

Solubility.—Soluble in alcohol, chloroform, and glacial acetic acid with not more than a slight opalescence; only partly soluble in ether or petroleum benzin.

Specific Gravity.—1.130 to 1.160 at 25° C. (77° F.).

Tests for Identity and Purity.—*Fixed Oils.*—One Gm. of the Balsam forms a clear solution when shaken with a solution of 3 Gm. of hydrated chloral in 2 mils of distilled water.

Turpentine or Rosin.—Shake about 1 Gm. of the Balsam with 5 mils of purified petroleum benzin, and warm the mixture on a water bath for 10 minutes, adding a sufficient quantity of the solvent to replace the loss by evaporation. On evaporating 2 mils of the benzin solution, no odor of turpentine is noticeable, and when the residue is treated with a few drops of nitric acid, no green or bluish color is produced.

Weigh accurately about 1 Gm. of the Balsam and dissolve it in 100 mils of alcohol, add 1 mil of phenolphthalein T.S. and titrate the solution with half-normal potassium hydroxide V.S. The acid number thus obtained is not less than 56 nor more than 84.

Mix about 3 Gm. of the Balsam, accurately weighed, with 30 mils of sodium hydroxide T.S. and shake the mixture for a few minutes with 60 mils of ether. Then add about 3 Gm. of powdered tragacanth, filter and transfer 50 mils of the ethereal filtrate (representing five-sixths of the weight of the Balsam taken) into a tared, conical flask. Evaporate the ether and dry the residue to constant weight at 100° C. (212° F.). The weight of the residue of cinnamein so obtained is not less than 50 per cent. nor more than 56 per cent. of the weight of the Balsam represented by the 50 mils of ethereal solution taken. Dissolve this residue in 25 mils of alcohol, add 25 mils of half-normal alcoholic potassium hydroxide V.S. and heat the mixture carefully in a flask provided with a reflux condenser, during half an hour on a water bath. Then add 1 mil of phenolphthalein T.S. and titrate the excess of alkali with half-normal hydrochloric acid V.S. The amount of half-normal alcoholic potassium hydroxide V.S. consumed corresponds to a saponification value for the cinnamein of from 235 to 238 (see U. S. P., Test No. 10 Chapter LXII).

N. F. Preparation.—Mistura Oleo-Balsamica.

Balsam of Peru contains *cinnamic* and *benzoic acids, benzyl cinnamate,* $C_9H_7(C_7H_7)O_2$, resin, *benzyl benzoate,* stilbene, etc.

Uses.—Balsam of Peru is very apt to be adulterated. It is used as a preservative for fats, ointments, etc.; internally, it is stimulant and aromatic. Dose, fifteen grains (1 Gm.).

BENZOINUM. U. S. Benzoin

[Benzoin.—GUM BENJAMIN]

A balsamic resin obtained from *Styrax benzoin* Dryander and some other species of *Styrax* (Fam. *Styracaceæ*) growing in the East Indies and known in commerce as Sumatra Benzoin and Siam Benzoin.

Sumatra Benzoin.—Official Description.—In blocks or lumps of varying size, made up of tears, compacted together with a reddish-brown, reddish-gray, or grayish-brown resinous mass; tears externally yellowish or rusty-brown, milky-white on fresh fracture; hard and brittle at ordinary temperatures, but softened by heat and becoming gritty on chewing.

Odor and Taste.—Odor aromatic and upon digesting with boiling water suggesting the odor of cinnamic acid or storax; taste aromatic and slightly acrid.

Tests for Identity and Purity.—Heat a few fragments of Sumatra Benzoin in a test tube; a sublimate is formed consisting of plates and small, rod-like crystals that strongly polarize light.

Add carefully an ethereal solution of Sumatra Benzoin to a small quantity of sulphuric acid contained in a porcelain dish; the solution is colored a brownish-red. Not less than 75 per cent. of Sumatra Benzoin dissolves in alcohol; the alcoholic solution, upon the addition of water, becomes milky and is acid to litmus.

Sumatra Benzoin does not yield more than 2.5 per cent. of ash.

Siam Benzoin.—Official Description.—In pebble-like tears of variable size, compressed yellowish-brown to rusty-brown externally, milky-white on fracture, separate or very slightly agglutinated; hard and brittle at ordinary temperatures but softened by heat, and becoming plastic on chewing.

Odor and Taste.—Odor agreeable, balsamic, vanilla-like; taste slightly acrid.

Tests for Identity and Purity.—Heat a few fragments of Siam Benzoin in a test tube; a sublimate is formed directly above the melted mass consisting of numerous long, rod-shaped crystals, which do not strongly polarize light.

Add carefully an ethereal solution of Siam Benzoin to a small quantity of sulphuric acid contained in a porcelain dish; the solution is colored purplish-red. Not less than 90 per cent. of Siam Benzoin dissolves in alcohol; the alcoholic solution upon the addition of water becomes milky and is acid to litmus.

Siam Benzoin does not yield more than 2 per cent. of ash.

The tests which follow apply to Sumatra and Siam Benzoin:

Rosin and Foreign Resins.—Heat gently 1 to 2 Gm. of Benzoin with 15 mils of purified petroleum benzin, and, after cooling, transfer the supernatant liquid to a separatory funnel, wash once with 10 mils of saturated sodium bicarbonate solution and then with water until free from bicarbonate; on the addition of 20 mils of a copper acetate solution (1 in 200) and vigorously shaking the mixture no green color is noticeable in the petroleum benzin layer.

Treat about 1 Gm. of powdered Benzoin with 15 mils of warm carbon disulphide, filter the solution, wash the filter with an additional 5 mils of carbon disulphide and allow the mixed liquids to evaporate spontaneously; not less than 12.5 per cent. of residue remains, which corresponds to the tests for identity under *Acidum Benzoicum.*

U. S. P. Preparations.—(From Siam Benzoin) Adeps Benzoinatus. (From any official Benzoin) Tinctura Benzoini; Tinctura Benzoini Composita.

N. F. Preparations.—Sevum Benzoinatum; Unguentum Picis Compositum (from Tincture).

Benzoin contains *benzoic acid, cinnamic acid* ($C_9H_8O_2$), a fragrant volatile oil, and resins. In some varieties *vanillin* is found. Alcohol is the best solvent for its active principles.

Uses.—It is a valuable stimulant and expectorant. Dose, fifteen grains (1 Gm.).

STYRAX. U. S. Storax

[LIQUID STORAX]

A balsam obtained from the wood and inner bark of *Liquidambar orientalis* Miller (Fam. *Hamamelidaceæ*).

Official Description.—A semi-liquid, grayish, sticky, opaque mass, depositing on standing a heavy, dark brown stratum; transparent in thin layers. It is heavier than water.

Odor and Taste.—A characteristic odor and an acrid taste.

Solubility..—Insoluble in water, but completely soluble (with the exception of accidental impurities) in an equal weight of warm alcohol; almost completely soluble in ether, acetone, benzene, or carbon disulphide.

Tests for Identity and Purity.—When heated on a water-bath, Storax becomes more fluid, and if it is then agitated with warm, purified petroleum benzin, the supernatant liquid, on being decanted and allowed to cool, is not darker than pale yellow and deposits white crystals of cinnamic acid and cinnamic esters. The separated crystals evolve the odor of benzaldehyde when heated with diluted sulphuric acid and potassium permanganate.

Incinerate about 0.5 Gm. of Storax; not more than 1 per cent. of ash remains.

Dissolve about 10 Gm. of Storax, accurately weighed, in 20 mils of hot alcohol; the undissolved residue, after washing it on a filter with hot alcohol and drying at 100° C. (212° F.), does not exceed 2.5 per cent. The combined filtrate and washings, after the evaporation of the alcohol at a temperature not exceeding 60° C. (140° F.) and drying the residue for one hour at 100° C. (212° F.), leave a brown, transparent, semi-liquid product representing not less than 60 per cent. of the weight of Storax taken; this product is soluble in ether, with the exception of a few flakes, but only partially soluble in purified petroleum benzin.

Dissolve about 1 Gm. of Storax, purified as described above, and accurately weighed, in 50 mils of alcohol, add 0.5 mil of phenolphthalein T.S., and titrate with half-normal alcoholic potassium hydroxide V.S. The acid value so obtained is not less than 56 nor more than 85 (see U. S. P., Test No. 10, Chapter LXII).

Mix about 1 Gm. of Storax, purified as described, and accurately weighed, in a 250 mil flask with 50 mils of purified petroleum benzin, add 25 mils of half-normal alcoholic potassium hydroxide V.S. and allow the mixture to stand twenty-four hours, with frequent shaking. Then add 0.5 mil of phenolphthalein T.S. and titrate with half-normal hydrochloric acid V.S. It shows a saponification value of not less than 170 nor more than 230 (see U. S. P., Test No. 9, Chapter LXII).

U. S. P. Preparation.—Tinctura Benzoini Composita.

Storax contains cinnamic acid, benzoic acid, *styracin*, $C_9H_7(C_9H_9)O_2$, *storesin*, $C_{36}H_{58}O_3$, *ethyl cinnamate*, $C_9H_7(C_2H_5)O_2$, *phenyl-propyl cinnamate*, $C_9H_7(C_9H_{17})O_2$, *styrol*, C_8H_8, a fragrant hydrocarbon, and a resinous substance not yet investigated. A large quantity of water is usually present.

Uses.—It is stimulant and expectorant. It may be used, like benzoin, to protect fatty substances from rancidity. Dose, fifteen grains (1 Gm.).

ACIDUM BENZOICUM. U. S. Benzoic Acid

[Acid. Benz.]

An organic acid obtained from benzoin, or prepared synthetically. It contains, when dried to constant weight in a desiccator over sulphuric acid, not less than 99.5 per cent. of $C_7H_6O_2$ or $C_6H_5.COOH$ (122.05). Preserve it in well-closed containers, in a cool place, protected from light

Preparation.—Benzoic acid is found naturally in benzoin, balsam of tolu, balsam of Peru, gum acroides, storax, and other resinous substances. It may be obtained from these by the process described on page 181; but, owing to the small yield afforded in this way, commercial benzoic acid is made artificially in several ways:

1. From the urine of cattle, by mixing it with lime in excess, evaporating and decomposing the lime hippurate with hydrochloric acid. The separated hippuric acid, after purification with animal charcoal, is treated with hydrochloric acid, when benzoic acid and *glycocine* are produced, the hydrochloric acid not being decomposed.

$$\underset{\text{Hippuric Acid}}{C_9H_9NO_3} + \underset{\text{Water}}{H_2O} = \underset{\text{Benzoic Acid}}{C_7H_6O_2} + \underset{\text{Glycocine}}{C_2H_5NO_2}$$

The benzoic acid is sometimes sublimed with benzoin to mask its disagreeable odor and imitate the acid sublimed from benzoin.

2. Benzoic acid may be made from *naphthalene*, $C_{10}H_8$, which, on treatment with nitric acid, yields *phthalic acid*, this, when heated with excess of calcium hydroxide, yields calcium benzoate and carbonate. The calcium benzoate is treated with hydrochloric acid and the benzoic acid is precipitated.

3. Benzoic acid is also largely made from toluene, C_7H_8, a coal tar hydrocarbon. Benzotrichloride is first formed, and this when heated with water in close vessels yields benzoic acid.

$$\underset{\text{Benzotrichloride}}{C_6H_5.CCl_3} + \underset{\text{Water}}{2H_2O} = \underset{\text{Benzoic Acid}}{C_6H_5.COOH} + \underset{\text{Hydrochloric Acid}}{3HCl}$$

Official Description.—It occurs in lustrous scales or friable needles. The synthetic Acid is white, odorless, or with a slight odor of benzaldehyde; the natural Acid is white or yellowish, acquires a darker color on exposure to light, and has a slight odor of benzoin. Benzoic Acid has a pungent taste, is somewhat volatile at moderately warm temperatures and freely volatile with steam. A saturated aqueous solution of Benzoic Acid is acid to litmus.

Solubility.—One Gm. of Benzoic Acid dissolves in 275 mils of water, 2.3 mils of alcohol, 4.5 mils of chloroform, 3 mils of ether, in 10 mils of benzene and in 23 mils of oil of turpentine at 25° C. (77° F.); also in 18 mils of boiling water, 1.5 mils of boiling alcohol, and in fixed or volatile oils.

Tests for Identity and Purity.—It melts between 120° and 122° C. (248° and 251.6° F.).

Benzoic Acid is freely dissolved by solutions of the alkali hydroxides; neutralize such a solution carefully and add ferric chloride T.S., previously diluted with 2 volumes of distilled water and neutralized, if necessary, with ammonia water; a pink precipitate of ferric benzoate is produced.

Incinerate about 2 Gm. of Benzoic Acid; not more than 0.05 per cent. of ash remains.

Readily Carbonizable Impurities.—A solution of about 0.1 Gm. of the synthetic Acid in 2 mils of sulphuric acid does not become darker than light yellow, when warmed for five minutes at 50° C. (122° F.). The color produced by the Acid from benzoin tested in the same manner does not become darker than light brown.

Chlorine.—Mix 0.5 Gm. of the Acid and about 1 Gm. of calcium carbonate (free from chloride) with a little distilled water in a crucible, dry the mixture and incinerate it at a low red heat. Dissolve the residue in 25 mils of diluted nitric acid (free from chloride) and filter. If the synthetic Acid is being tested, the addition of 0.5 mil of silver nitrate T.S. to the filtrate does not produce a greater turbidity than is produced by the same quantity of the reagent in a mixture of 25 mils of distilled water and 0.1 mil of tenth-normal hydrochloric acid V.S. If the Acid from benzoin is being tested, the turbidity is not greater than that produced by the same quantity of reagent in a mixture of 25 mils of distilled water and 0.05 mil of tenth-normal hydrochloric acid V.S.

Cinnamic Acid.—Warm 0.5 Gm. of the Acid with 5 mils of distilled water and 0.5 Gm. of potassium permanganate in a loosely-stoppered test tube, and place it in a water bath, heated to about 45° C. (113° F.), for ten minutes. Stopper the test tube tightly and allow it to cool. On removing the stopper, no odor of benzaldehyde is perceptible.

Assay.—Dissolve about 0.5 Gm. of Benzoic Acid, previously dried to constant weight in a desiccator over sulphuric acid and accurately weighed, in 25 mils of diluted alcohol which has been previously neutralized with tenth-normal potassium hydroxide V.S., phenolphthalein T.S. being used as indicator. Titrate this solution with tenth normal barium hydroxide V.S., using phenolphthalein T.S. as indicator. It shows, in the dried acid, not less than 99.5 per cent. of $C_7H_6O_2$. Each mil of tenth-normal barium hydroxide V.S. used corresponds to 0.012205 Gm. of $C_7H_6O_2$. Each gramme of Benzoic Acid, previously dried, corresponds to not less than 81.5 mils of tenth-normal barium hydroxide V.S.

U. S. P. Preparation.—Tinctura Opii Camphorata.
N. F. Preparation.—Nebula Aromatica.

Uses.—This acid is useful in forming *benzoates*, a class of salts which have been employed frequently during the last few years. It is stimulant, expectorant, and irritant to the mucous membranes. Dose, eight grains (0.5 Gm.), administered in thick mucilage or syrup.

AGARICUS. N. F. Agaric

[**Agaric.**—White Agaric Larch Agaric]

The dried fruit body of the fungus *Polyporus officinalis* Fries (Fam. *Polyporaceæ*) [growing on one or more species of *Pinus* Linné, *Larix* Adanson, and *Picea* Link (Fam. *Pinaceæ*)], deprived of its outer rind, and without the presence of more than 10 per cent. of foreign matter. It contains an active principle known as *agaracin*, also resin.

Official Description.—Light, fibrous, somewhat spongy pieces of irregular shape; grayish-white to pale brown externally; yellowish and resinous internally; fracture tough, fibrous; friable but difficult to powder.

Tests for Identity and Purity.—The powdered drug, examined under the microscope, shows numerous non-septate, narrow, mycelial threads and many cubical crystals of calcium oxalate from 0.01 to 0.02 mm. in diameter.

It yields to boiling alcohol not less than 50 per cent. of a resinous extract.

Agaric yields not more than 2 per cent. of a white ash, rich in phosphates.

N. F. Preparations.—Pilulæ Antiperiodicæ; Pilulæ Antiperiodicæ sine Aloe; Tinctura Antiperiodica; Tinctura Antiperiodica sine Aloe; Tinctura Zedoariæ Amara.

Uses.—Used as a counterirritant and internally in doses of five to ten grains (0.32 to 0.65 Gm.) in the night sweats of phthisis.

GUTTA PERCHA. N. F. Gutta Percha

The purified, coagulated, milky exudate of various trees of the genus *Palaquium* Blanco (Fam. *Sapotaceæ*).

Official Description.—In masses, sticks or sheets of irregular size and shape, tough, yellowish-white in color and usually with reddish, marbling streaks.

Solubility.—Insoluble in water; partly soluble in chloroform, carbon disulphide, petroleum benzin, or oil of turpentine, leaving not more than 10 per cent. of undissolved residue.

Tests for Identity and Purity.—Slightly elastic at ordinary temperatures, becoming pliable at from 25° to 30° C. (77°–86° F.). It gradually softens on further heating becoming quite plastic at 60° C. (140° F.).

One Gm. of Gutta Percha when boiled for one hour with 20 mils of dehydrated alcohol in a flask, connected with a reflux condenser, leaves not less than 0.5 Gm. of undissolved residue.

When exposed to air and sunlight, Gutta Percha absorbs oxygen and becomes brittle.

Gutta Percha yields not more than 5 per cent. of ash.

N. F. Preparation.—Liquor Guttæ Perchæ.

Uses.—An adhesive, used for the preparation of the N. F. solution.

LIQUOR GUTTÆ PERCHÆ. N. F. Solution of Gutta Percha
[Liq. Gut. Perch.]

	Metric	Old form
Gutta Percha, in thin slices	15 Gm.	231 grains
Chloroform	100 mils	3 fl. oz. 183 min.
Lead Carbonate, in fine powder	17 Gm.	262 grains

Add the gutta percha to 75 mils [old form about 2½ fl. oz.] of the chloroform, contained in a bottle, stopper tightly and shake it occasionally until the gutta percha is dissolved. Then add the lead carbonate, previously mixed with the remainder of the chloroform, and, having shaken the whole together several times, at intervals of half an hour, set the mixture aside until the insoluble matter has subsided and the solution has become clear. Decant the clear liquid and preserve it in small, cork-stoppered bottles.

DIOSCOREA. N. F. Dioscorea
[Diosc.—Wild Yam Root]

The dried rhizome of *Dioscorea villosa* Linné (Fam. *Dioscoreaceæ*). It contains resin and a saponin-like principle.

Official Description.—Knotted and woody, elongated, from 6 to 12 mm. in thickness, often compressed, bent and branched, bearing scattered nodular projections at the sides, slender tough roots underneath and stem-scars on the upper surface; externally pale brown, surface more or less scaly from the partly detached, thin outer layer; fracture short but tough, the fractured surface whitish or pale-brown, with numerous small, scattered, yellowish wood bundles.

Odor and Taste.—Odorless, taste starchy, insipid, afterwards acrid.

Test for Identity and Purity.—Dioscorea yields not more than 7 per cent. of ash.

Uses.—It is used as an expectorant, and diaphoretic, and also in rheumatism. Dose, one drachm (4 Gm.).

DROSERA. N. F. Drosera
[Droser.—Sundew]

The air-dried flowering plant of *Drosera rotundifolia* Linné (Fam. *Droseraceæ*), frequently mixed with the closely allied species *Drosera intermedia* Hayne and *Drosera longifolia* Linné, or at times wholly replaced by these.

It contains an acrid resin, citric and malic acid and a ferment.

Official Description.—A delicate plant of a reddish color throughout, with a few fibrous, blackish rootlets; leaves all in a basal rosette, blade orbicular, about 15 mm. in diameter, abruptly contracted into a slender, pubescent petiole, upper surface covered with prominent glandular hairs; scape filiform, smooth, from 10 to 20 cm. in length, bearing a few, five-parted, small, white fugacious flowers in a curved, one-sided raceme.

Drosera intermedia is identified by its spatulate leaves with blades two or three times as long as they are wide and glabrous petioles. *Drosera longifolia* is identified by its elongated spatulate obovate leaves with blades six to eight times as long as they are wide, and its slender smooth petioles and scape, declinate at base.

Odor and Taste.—Odorless; taste faintly bitter and acidulous.

Test for Identity and Purity.—Drosera yields not more than 30 per cent. of ash.

Uses.—It is used in chronic bronchitis, whooping-cough, and tuberculosis, but is apparently of little value. Dose, one drachm (4 Gm.).

ECHINACEA. N. F. Echinacea
[Echin.]

The dried rhizome and roots of *Brauneria pallida* (Nuttall) Britton (*Echinacea angustifolia* De Candolle) (Fam. *Compositæ*).

It contains an acrid resin, and a minute amount of an alkaloid.

Official Description.—Nearly entire, cylindrical, very slightly tapering and sometimes slightly spirally twisted, from 10 to 20 cm. in length and from 4 to 13 mm. in diameter, externally grayish-brown, light brown or purplish-brown, slightly annulate in the upper portion, with occasional V-shaped stem scars, somewhat longitudinally wrinkled, or furrowed; fracture short, fibrous, bark less than 1 mm. in thickness, wood thick and composed of alternate light yellowish and black wedges; the rhizome with a circular pith.

Odor and Taste.—Odor faint, aromatic; taste sweetish, followed by a tingling sensation suggesting aconite, but lacking the persistent and benumbing effect produced by that drug.

Tests for Identity and Purity.—Under the microscope, sections show the presence of intercellular (schizogenous) oil and resin cavities or reservoirs in both the wood and bark, numerous stone cells distinguished by the presence of a blackish, resinous substance in the intercellular spaces between them and some of the adjoining parenchyma, the latter containing masses or aggregates of inulin. The walls of the tracheæ or vessels are marked with simple slit-like pores or annular and reticulate thickenings; bast fibers occur in the stem, and in some specimens true libriform or wood fibers are found.

Echinacea yields not more than 6 per cent. of ash.

N. F. Preparation.—Fluidextractum Echinaceæ.

Uses.—It is used as an alterative, diaphoretic, and antisyphilitic. Also used in eczema. Dose, fifteen grains (1 Gm.).

EUPHORBIA PILULIFERA. N. F. Euphorbia Pilulifera
[Euphorb. Pilul.—PILL BEARING SPURGE]

The dried herb of *Euphorbia pilulifera* Linné (Fam. *Euphorbiaceæ*), collected while flowering and fruiting.

It contains an acrid resin.

Official Description.—Roots usually present, small, branched, and reddish; stems slender, cylindrical, obliquely erect, dichotomously branched from near the base, branches recurved at apices; branches and stem only sparsely leafed at base, pale greenish-brown, rough or hairy; stems coarsely pilose with yellow hairs which are rather dense on the upper parts but sparse on the lower; pubescence consisting of short, nearly straight unicellular hairs, becoming almost hispid at the flowering tops; leaves, opposite, obliquely oblong, acute, serrulate, rusty pale green, pubescent especially on the prominent veins on the lower surface, becoming brittle on drying and usually much broken in the drug; flowers small, numerous, in short peduncled axillary clusters; fruits about 1 mm. in diameter, three-celled capsules; seeds about 0.9 mm. in diameter, triangular ovoid, pale brown.

Odor and Taste.—Odor aromatic and characteristic; taste faintly bitter, aromatic and acrid.

Test for Identity and Purity.—Euphorbia Pilulifera yields not more than 12 per cent. of ash.

N. F. Preparation.—Fluidextractum Euphorbiæ Piluliferæ.

Uses.—It is used as an antispasmodic and expectorant; dose, thirty grains (2 Gm.).

JUGLANS. N. F. Juglans
[Juglan.—BUTTERNUT BARK]

The dried inner bark of the roots of *Juglans cinera* Linné (Fam. *Juglandaceæ*), collected in the autumn.

It contains a crystalline resin, *juglandic acid*, gum, sugar, etc.

Official Description.—In quills, curved strips, or in chips, from 3 to 10 mm. in thickness; of a deep brown odor on both surfaces and throughout, except for the faint, intersecting, whitish, radial, and tangential lines shown in the transverse section; outer surface smooth, somewhat warty; inner surface smooth and striate, bearing fragments of thin stringy fiber; fracture short, rather weak, somewhat fibrous.

Odor and Taste.—Odor faintly aromatic; taste bitter, astringent, somewhat acrid.

Tests for Identity and Purity.—The powdered drug is dark-brown and, when examined under the microscope, exhibits numerous rosette aggregates, crystals of calcium oxalate, up to 0.050 mm. in diameter; simple rounded or occasionally 2- to 4-compound starch grains, the individual grains being up to 0.015 mm. in diameter, sometimes with a cleft through the center; stone cells, some with thick walls, with simple or branching pores, up to 0.10 mm. long and 0.05 mm. wide, sometimes with reddish contents; long thin-walled sclerenchymatous fibers up to 0.03 mm. in width, occasionally associated with crystal fibers, the latter containing prisms of calcium oxalate from 0.01 to 0.05 mm. in length; fragments of parenchyma containing brownish tannin masses and oil; fragments of epidermal tissue composed of polygonal cells having yellowish brown walls, some with reddish-brown contents.

Juglans yields not more than 8 per cent. of ash.

N. F. Preparations.—Elixir Cascaræ Sagradæ Compositum (from Fluidextract); Fluidextractum Juglandis.

Uses.—A mild cathartic and hepatic stimulant. Dose, one drachm (4 Gm.).

KAVA. N. F. Kava

[METHYSTICUM KAVA KAVA]

The dried rhizome and roots of *Piper methysticum* Forster (Fam. *Piperaceæ*).

Its chief constituent is a resin present to the extent of about 5 per cent. Small amounts of other principles, glucosidal and alkaloidal in character, are said to be present.

Official Description.—Consisting of a large, irregular knotty crown, often 12 cm. or more in diameter, from which proceed numerous, long, cylindrical, tough, nearly simple roots, which tend to fray out into bare, separated fibro-vascular bundles; the crown soft, light, spongy, and granular and very starchy; externally dark-brown or blackish, the crown frequently partly scraped and light brown to light gray; internally white.

Odor and Taste.—Odor faint but characteristic; taste aromatic and pungent, slightly bitter, more or less local anæsthesia resulting.

Tests for Identity.—The powdered drug, when examined under the microscope, exhibits numerous, simple, or two- to three-compound starch grains, the individual grains being up to 0.045 mm. in diameter, many with radial clefts or triangular fissures at the center; yellow resin and oil cells; narrow sclerenchymatous fibers with thin, strongly-lignified walls; tracheæ with scalariform or reticulate markings, up to 0.15 mm. in width; few nearly isodiametric wood parenchyma from the remains of the stem.

Kava yields not more than 8 per cent. of ash.

N. F. Preparation.—Fluidextractum Kavæ.

Uses.—A stimulant, diuretic, diaphoretic and tonic. The dose is fifteen grains (1 Gm.).

MASTICHE. N. F. Mastic

(U.S.P. VIII)

[*Mastic.*]

A concrete resinous exudation from *Pistacia lentiscus* Linné (Fam. *Anacardiaceæ*).

Mastic contains a resin (mastichic acid, $C_{20}H_{32}O_2$), which is soluble in strong alcohol; also masticin, a resinous principle which is insoluble in alcohol; a small quantity of volatile oil is likewise present.

Official Description.—In sub-globular, lenticular, elongated or pear-shaped tears, about 3 mm. in diameter, pale yellow or greenish-yellow, transparent, having a glass-like luster, the surface sometimes very slightly dusty; brittle, becoming plastic when chewed.

Odor and Taste.—Odor slight, balsamic; taste mild, terebinthinate.

Tests for Identity.—Mastic is completely soluble in ether and almost completely soluble in alcohol. The acid number, determined as directed by the U.S.P., Test No. 10, Chapter LXII is not less than 65.

N. F. Preparations.—Pilulæ ad Prandium (Chapman's); Pilulæ Aloes et Mastiches.

Uses.—It is used in pills of aloes and mastic to modify the action of the aloes; in the arts it is employed to form a varnish. Dose, thirty grains (2 Gm.).

PINUS ALBA. N. F. White Pine Bark

[Pinus Alb.]

The dried inner bark of *Pinus Strobus* Linné (Fam. *Pinaceæ*).

It contains tannin, gum, resin, and a peculiar body known as *coniferin*, ($C_{16}H_{22}O_8.H_2O$). This substance yields vanillin upon oxidation.

Official Description.—In flat pieces of variable size and from 1 to 3 mm. in thickness; outer surface varying from a pale pinkish-white when fresh, to a light or rather deep-yellowish-brown on keeping, occasionally with small patches of the gray-brown periderm adhering; more or less cottony, and often showing small scattered pits; inner surface either lighter or darker than the outer, finely striate; fracture tough, fibrous; transverse section showing an outer yellowish and an inner whitish band.

Odor and Taste.—Odor slight, terebinthinate; taste slightly mucilaginous, bitter, sweet and astringent.

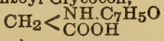
Tests for Identity and Purity.—The powdered drug, when examined under the microscope, exhibits numerous rounded or oval, simple starch grains, up to 0.03 mm. in diameter, some having a cleft or fissure through the center; few monoclinic prisms of calcium oxalate about 0.02 mm. in diameter; resin in reddish-brown, angular masses; thin-walled parenchyma cells, isodiametric to elongated, many containing starch grains; tracheids very few or absent.

White Pine Bark yields not more than 3 per cent. of ash.

N. F. Preparations.—Syrupus Pini Strobi Compositus; Syrupus Pini Strobi Compositus cum Morphina.

Uses.—It is used as an expectorant in doses of thirty grains (2 Gm).

Unofficial Products from Oils and Substances Containing Resins

Alkanet	The root of *Anchusa tinctoria.* Used exclusively for coloring oils, ointments, and plasters, which are beautifully reddened by 1/40 of their weight of the root
Ammoniacum Ammoniac. U. S. P. 1890	A gum-resin obtained from *Dorema Ammoniacum* Don (Fam. *Umbelliferæ*). It contains 25 per cent. gum, 70 per cent. resin, and about 3 per cent. volatile oil. It is expectorant and stimulant. Dose, fifteen grains (1 Gm.)
Annatto	A coloring substance, consisting of the pulp which surrounds the seeds in the fruit of *Bixa Orellana.* Used for coloring cheese and butter, and for dyeing silk and cotton orange-yellow
Bdellium Bdellium	From *Balsamodendron Mukul*, grown in India. It contains volatile oil and resin
Benzoyl Glycocoll,  $CH_2<\substack{NH.C_7H_5O\\COOH}$	The dose of benzoyl glycocoll, or *sodium hippurate*, is ten grains (0.65 Gm.) three times a day
Copal	A resinous substance, brought principally from the East Indies. Used for making varnish
Doundaké	An astringent and tonic febrifuge
Elastica, Rubber (India Rubber) U. S. P. VIII	The prepared milk-juice of several species of *Hebea* Aublet (Fam. *Euphorbiaceæ*), known in commerce as Para Rubber. It is used as the base for machine-made plasters
Elemi Elemi	From *Cannarium commune*, grown in the Philippine Islands. It contains 10 per cent. of volatile oil, $C_{10}H_{16}$, and 25 per cent. of resin
Euphorbium Euphorbium	From *Euphorbium resinifera*, found in Morocco. It contains 18 per cent. of gum and 38 per cent. of resin, etc.
Galbanum Galbanum	From *Ferula galbaniflua.* It contains 8 per cent. of volatile oil and 85 per cent. of resin. Dose, fifteen grains (1 Gm.)
Gurjun Wood Oil	From *Dipterocarpus turbinatus.* It contains about 40 per cent. of volatile oil and resin
Hippuric Acid, ($C_9H_9NO_3$)	Suggested as a remedy in the uric acid diathesis

Unofficial Products from Oils and Substances Containing Resins—*Continued*

Labdanum Ladanum	A stimulant expectorant. At present used only in plasters
Lac Lacca	A reddish-brown resin. Formerly used in medicine, but at present chiefly for making varnish; also in making sealing wax
Liquidambar Styraciflua (Copalm Balsam)	Stimulant and expectorant. The bark of the tree is astringent, and is used in diarrhœa and dysentery, especially for children, given in the form of a syrup
Olibanum Frankincense	From several species of *Boswellia*, found in Africa. It contains 6 per cent. of volatile oil and 56 per cent. of resin
Pix Burgundica Burgundy Pitch. U. S. P. 1890	The prepared resinous exudation of *Abies excelsa* Poiret (Fam. *Coniferæ* Used in making plasters
Pix Canadensis Canada Pitch	From *Abies canadensis*. Used in making plasters
Resina Draconis Dragon's Blood	The resin from the fruit of *Calamus Draco*. It contains a peculiar resin, $C_{20}H_{20}O_2$, etc.
Retinol	A yellowish oil, boiling at 280° C. (536°F.) Mildly antiseptic. Good solvent of phosphorus
Sagapenum	Stimulant, antispasmodic. Dose, ten to thirty grains (0.65 to 2 Gm.). Used also externally in plasters as a discutient
Sandarach Gum Juniper	Used chiefly as a varnish and as incense. Formerly given internally, and used in ointments and plasters
Succinum Amber	Contains succinic acid, and a volatile oil which is stimulant and antispasmodic, or rubefacient when applied externally
Terebinthina Canadensis Canada Turpentine (Balsam of Fir Canada Balsam) U. S. P. VIII	A liquid oleoresin obtained from *Abies balsamea* (Linné) Miller (Fam. *Coniferæ*) (see Reagents, Chapter LXII). Used externally but chiefly for mounting microscopic objects
Terpinol, $(C_{10}H_{16})_2+H_2O$	Derivative of oil of turpentine. In colorless crystals. Dose, three to four grains (0.2 to 0.25 Gm.)
Viscum Album Mistletoe	Oxytocic. Dose, a fluidrachm (4 mils) of the fluidextract

Eclectic Resinoids

These so-called active principles are made by adding a concentrated alcoholic tincture of the drug to a large quantity of water, and collecting the precipitate. They are largely used by the eclectic practitioners, and vary greatly in properties and effects. *They must not be confounded with true active principles,* although the names are often exactly the same; this fact often leads to annoyance in dispensing, and has been the cause of dangerous mistakes. A list of the *resinoids* most frequently used is appended.

Alnuin	From the bark of *Alnus rubra*. The dose is about one to three grains (0.065 to 0.2 Gm.)
Ampelopsin	From the branches and bark of *Ampelopsis quinquefolia*. The dose is from two to eight grains (0.13 to 0.5 Gm.)
Apocynin	From the root of *Apocynum androsæmifolium*. It yields about one ounce of apocynin from two pounds of drug. The dose is from one-half to two grains (0.03 to 0.13 Gm.)
Asclepidin	From the root of *Asclepias tuberosa*. The dose is from one to five grains (0.065 to 0.32 Gm.)
Baptisin	From the root of *Baptisia tinctoria*. It is of a yellowish-brown color. The dose is from one-third to one grain (0.022 to 0.065 Gm.)
Barosmin	From the leaves of *Barosma betulina* and other species. The dose is from one to four grains (0.065 to 0.25 Gm.)
Caulophyllin	From the root of *Caulophyllum thalictroides*. It yields about 12 per cent. of caulophyllin. The dose is from one-quarter to one grain (0.016 to 0.065 Gm.)
Ceanothin	From the root of *Ceanothus americanus*.
Cerasein	From the bark of *Cerasus virginiana*. The dose is from five to ten grains (0.32 to 0.65 Gm.)
Chelonin	From the herb of *Chelone glabra*. The dose is from one to two grains (0.065 to 0.13 Gm.)
Chimaphilin	From the leaves of *Chimaphila umbellata*. The dose is from one to four grains (0.065 to 0.25 Gm.)
Cimicifugin	From the rhizome of *Cimicifuga racemosa*. It yields about 5 per cent. It is also called Macrotin. The dose is from one to six grains (0.065 to 0.38 Gm.)
Collinsonin	From the herb of *Collinsonia canadensis*. The dose is about three grains (0.2 Gm.)
Cornin	From the bark of the root of *Cornus florida*. The dose is about five grains (0.32 Gm.)
Corydalin	From the tubers of *Dicentra canadensis*. It yields about one-half ounce of corydalin from two pounds of the tubers. The dose is from one-half to two grains (0.03 to 0.13 Gm.)
Cypripedin	From the rhizome of *Cypripedium pubescens*. The dose is about two grains (0.125 Gm.)

Dioscorein	From the root of *Dioscorea villosa.* The dose is from two to five grains (0.13 to 0.32 Gm.)
Euonymin	From the bark of *Euonymus atropurpureus.* The dose is from one-fourth to four grains (0.016 to 0.25 Gm.)
Eupatorin	From the leaves and flowering tops of *Eupatorium perfoliatum.* The dose is from two to four grains (0.13 to 0.25 Gm.)
Euphorbin	From the root of *Euphorbia corollata.* The dose is from one-half to two grains (0.03 to 0.13 Gm.)
Fraserin	From the root of *Frasera Walteri.* The dose is from one to five grains (0.065 to 0.32 Gm.)
Gelsemin	From the rhizome of *Gelsemium sempervirens.* The dose is from one-half to two grains (0.03 to 0.13 Gm.)
Hamamelin	From the root of *Hamamelis virginiana.* The dose is about five grains (0.32 Gm.)
Helonin	From the root of *Helonias dioica.* The dose is from one-half to two grains (0.03 to 0.13 Gm.)
Hydrastin	From the rhizome of *Hydrastis canadensis.* The dose is from three to five grains (0.2 to 0.3 Gm.)
Juglandin	From the bark of the root of *Juglans cinerea.* The dose is from two to five grains (0.13 to 0.32 Gm.)
Leptandrin	From the root of *Leptandra virginica.* The dose is from two to four grains (0.13 to 0.25 Gm.)
Lupulin	From the strobiles of *Humulus Lupulus.* The dose is from five to ten grains (0.32 to 0.65 Gm.)
Lycopin	From *Lycopus virginicus.* The dose is from three to five grains (0.2 to 0.32 Gm.)
Macrotin	See Cimicifugin
Menispermin	From *Menispermum canadense.* The dose is about two grains (0.13 Gm.)
Myricin	From *Myrica cerifera.* The dose is from two to eight grains (0.13 to 0.5 Gm.)
Phytolaccin	From *Phytolacca decandra.* The dose is from one-quarter to one grain (0.016 to 0.065 Gm.)
Populin	From the bark of *Populus tremuloides.* The dose is from two to five grains (0.13 to 0.32 Gm.)
Prunin	From *Cerasus serotina.* The dose is about two grains (0.13 Gm.)
Ptelein	From the root of *Ptelea trifoliata*
Rhein	From different species of *Rheum.* The dose is from two to four grains (0.13 to 0.25 Gm.)
Rhusin	From the leaves of *Rhus glabra.* It is said to be a light brown powder
Rumin	From *Rumex crispus.* The dose is about two grains (0.13 Gm.)
Sanguinarin	From *Sanguinaria canadensis.* The dose is from one-half to two grains (0.03 to 0.13 Gm.)
Scutellarin	From the herb of *Scutellaria lateriflora.* The dose is from three to six grains (0.2 to 0.38 Gm.)
Senecin	From *Senecio gracilis.* The dose is from three to five grains (0.2 to 0.32 Gm.)
Senecionin	From *Senecio gracilis.* The dose is from one to five grains (0.065 to 0.32 Gm.)
Smilacin	From different species of *Smilax.* The dose is from two to five grains (0.13 to 0.32 Gm.)
Stillingin	From *Stillingia sylvatica.* The dose is one-half to one grain (0.03 to 0.065 Gm.)
Trillin	From *Trillium pendulum.* The dose is from three to six grains (0.2 to 0.38 Gm.)
Viburnin	From *Viburnum Opulus.* The dose is about two grains (0.13 Gm.)

QUESTIONS ON RESINS, OLEORESINS, GUM RESINS, AND BALSAMS

What are resins and how are they characterized? (See page 1215). What are they chemically?
What are natural oleoresins? What are gum resins? What are balsams?
Oil of turpentine—What is the Latin name? Give the synonyms. How it is defined?
What is its chemical composition? What is its specific gravity?
Describe odor, taste and solubility.
Give the tests for identity and purity.
For what is it used medicinally?
What are its official preparations?
Rectified oil of turpentine—What is the Latin official title? How is oil of turpentine rectified? Give the details of the process.
Give description, specific gravity, and test for identity. For what is it used internally? Give the dose. Name the official preparation.
Terebene—Give the Latin title. How is this substance made?
Give the description, odor, taste, specific gravity, solubility, and tests for identity and purity.
For what is it used medicinally? Give the dose.
Terpin hydrate—Give the Latin title and chemical formula in symbols. What is this substance chemically? How may it be made?
Give description, odor, taste, chemical reaction, solubility, and tests for identity and purity.

For what is it used medicinally? Give the dose.
What are its official preparations?
Rosin—What is its synonym? How is it obtained? Give the official description and tests.
For what is it used? What are its official preparations?
Turpentine—What is its Latin title? What is its definition?
What does it contain? Give the description, odor, taste, and chemical reaction and tests for impurities.
For what is it used in pharmacy? What is the dose?
Oil of dwarf pine needles—What is the Latin title and synonym? What is its source? Name the constituents present in this oil. What are its uses?
Venice turpentine—Give the Latin title and synonym. What is the official definition? Describe its appearance, odor, and taste. What are its uses?
Asafetida—What is the Latin official name? Give the synonym. What standard is required by the U. S. P. for "whole asafetida"? For "powdered asafetida"? What is its definition and description?
What are its constituents?
What does this volatile oil contain?
What does the resin yield by treatment with potassium hydroxide?
What does it yield by dry distillation?
What is the best solvent for its valuable principles?
Will water extract its virtues? How? What is its use and the dose?
What are its official preparations?
Myrrh—What is its synonym? Give the source. Give the official description.
What does it contain? What are its active principles?
What is its best solvent? For what can the gum left after macerating myrrh in alcohol be used? Mention the official preparations in which myrrh is an ingredient. What is the dose?
Guaiac—What is the Latin name? What is the synonym? How is this resin prepared?
Give the official definition and description. What should be the color of the powder? What change occurs if it is exposed to the air?
What effect does chlorine water or tincture of ferric chloride have upon an alcoholic solution?
How may an impurity of rosin be detected?
Of what does it consist? What are the best solvents for guaiac?
Why is a solution of guaiac colored blue by oxidizing agents?
What is the dose? What are the official preparations?
Guaiac wood—What is the Latin title. Give the synonym and official definition. What is its chief constituent. Describe the drug. Into what N. F. preparation does it enter? Give uses and dose.
Balsam of tolu—What is the Latin name? What is its source?
What does it contain?
Give the description, odor, taste, and solubility. What tests are given to prove the absence of impurities?
What are its medicinal properties? What are its official preparations and uses?
Balsam of Peru—What is the Latin name? What is its source?
What does it contain?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity and specific gravity.
How may the following impurities be detected?—viz.: Fixed oils; rosin; turpentine? Into what N. F. preparation does it enter? What are its medicinal and pharmaceutical uses?
Benzoin—Give the Latin title and synonym? What is its source.
Give the description and characteristics of Siam Benzoin. Of Sumatra Benzoin.
What does it contain? What is its best solvent?
What are its uses and the dose? What are the official preparations?
Storax—What is the Latin name? Give the synonym. What is its source?
What does it contain? Give description, odor, taste, solubility, and tests for identity. Into what preparation does it enter?
What are its medicinal properties? For what is it used?
Benzoic acid—Give formula in symbols, and Latin name.
Where is it found, and how may it be obtained?
How is it prepared artificially from urine?

How is this acid sometimes treated to disguise its odor?
How is it made from naphthaline?
How is it made from toluene?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Readily carbonizible organic matters; more than traces of chlorine; cinnamic acid. For what is it used medicinally? What is the dose?
Agaric—What is the Latin title and synonym? Give the official definition and description. What are its constituents? Give the uses and dose.
Gutta percha—What is this substance? Describe its appearance and solubilities. What are its uses?
Solution of gutta percha—How is it prepared? Why is lead carbonate used?
Dioscorea—What is the synonym? Give the definition and description. What are its uses and the dose?
Drosera—What is the synonym? Give the definition and description. What are its constituents? What are its uses and the dose?
Echinacea—Give its definition and description. What are its constituents, uses, and dose?
Euphorbia pilulifera—What is its synonym? Give its definition and description. What is its chief constituent. What are its uses and the dose?
Juglans—Give the synonym. What is the N. F. definition and description? Name its most important constituents. What are its official preparations? Give the uses and dose.
Kava—What is its synonym? Give the N. F. definition and description. What are its constituents? What are its uses and dose?
Mastic—Give definition and description. What are its constituents? Give its uses and the dose.
What are eclectic resinoids, and how are they usually prepared?
Are they the active principles of the drugs from which they are prepared?

CHAPTER LVIII

FIXED OILS, FATS, AND SOAPS

FIXED oils and fats are obtained from both the vegetable and the animal kingdom. They are greasy to the touch, and leave a permanent oily stain on paper; they are insoluble in water, but dissolve in ether, chloroform, carbon disulphide, benzene, petroleum benzin, oil of turpentine, and volatile oils; they usually mix with one another without separating.

When pure, they are generally colorless or have a pale yellow color; they have a distinctive odor and taste, which is often caused by impurities with which they are associated, as the process of refining deprives them of odor and taste.

When heated moderately, if solid they melt, or if liquid they become thinner; if heated strongly in air they are decomposed, evolve offensive vapors, and then burn with a sooty flame, much heat being generated. Their specific gravity varies from 0.870 to 0.985, thus being lighter than water. By exposure to air they acquire an acrid, disagreeable taste and become acid to litmus paper. This change, termed *rancidity*, is believed to be due to the presence of impurities (like albuminous substances), which act as ferments, induce decomposition, liberate the fatty acids, and produce volatile, odorous acids, like caproic, caprylic, butyric, and valeric acids. Oils which have become rancid may often be purified by shaking them thoroughly with hot water and then with a cold solution of sodium carbonate, and subsequently washing them with cold water.

Chemically, the fixed oils and fats are esters of higher members of the fatty acids, the alcohol being glycerin and the radical glyceryl. In most cases they consist of two or three proximate principles,—olein, palmitin, or stearin. These are sometimes termed the glycerides of oleic, palmitic, and stearic acids. Olein is liquid, and palmitin and stearin are both solid; hence the consistence of fixed oils and fats is due to the relative proportion of these principles; thus, almond oil, being composed principally of olein, is always liquid at ordinary temperatures, while tallow, being largely stearin, is solid.

Olein, $C_3H_5(C_{18}H_{33}O_2)_3$, is the oleate of the triad radical glyceryl, and constitutes the liquid principle of oils. It is extremely difficult to obtain it pure. Being in most oils associated with the solids stearin and palmitin, it has to be separated by pressure and other mechanical means, and this is not easily effected. As ordinarily procured, therefore, olein contains more or less of palmitin or stearin, or both. It is obtained either by the agency of alcohol or by expression. When one of the oils, olive oil, for example, is dissolved in boiling alcohol, the solution, on cooling, deposits the concrete principles, retaining the olein, which it yields upon evaporation. The other method consists in compressing one of the solid fats, or of the liquid oils rendered concrete by cold, between folds of bibulous paper, which absorb the olein, and give it up afterwards by compression under water. Olein is a liquid of oily consistence, congealing at —6° C. (21.2° F.), colorless when pure, with little odor and a sweetish taste, insoluble in water, soluble in alcohol and ether.

The *hydrogenation of oils,* whereby oleic acid or an oleate, when treated with hydrogen in the presence of a catalytic agent such as finely divided metallic nickel, is changed into stearic acid or stearate, has become an important commercial process. The *hydrogenation of cottonseed oil* produces a solid fat which has been largely used in cooking, replacing lard, and has been suggested for ointments. The claim is made that it is less subject to rancidity than lard and is quickly absorbed by the skin.

Palmitin.—Palmitic acid occurs in the more liquid fats, such as palm oil and cocoanut oil, as glyceride; while in spermaceti and some forms of wax it is combined with monatomic alcohol radicals. Palmitin is the *glyceride of palmitic acid* or *glyceryl tripalmitate.*

Stearin.—This exists abundantly in tallow and other animal fats, and is made on an immense scale for use in candles by cooling lard and tallow, and separating the olein by hydraulic pressure. It may be obtained pure by dissolving suet in hot oil of turpentine, allowing the solution to cool, submitting the solid matter to expression in unsized paper, repeating the treatment several times, and finally dissolving in hot ether, which deposits the stearin on cooling. This is white, opaque in mass, but of a pearly appearance as crystallized from ether, pulverizable, fusible at 66.5° C. (151.3° F.), soluble in boiling alcohol and ether, but nearly insoluble in those liquids cold, and quite insoluble in water. It consists of glyceryl and stearic acid, as a glyceride, $C_3H_5(C_{18}H_{35}O_2)_3$, and has been formed synthetically by heating a mixture of these two materials to 280° to 300° C. (536°–572° F.).

Margarin.—What was long known under this name was shown by Heintz, in 1852, to be a mixture of stearin and palmitin. The true *margaric acid,* $C_{17}H_{34}O_2$, has been obtained by synthesis, and according to Ebert is found in *adipocere,* a waxy substance formed in the tissues of dead animals.

Stearic acid, $C_{18}H_{36}O_2$, is a firm, white, solid, like wax, fusible at 69.4° C. (157°F.), greasy to the touch, pulverizable, soluble in alcohol, very soluble in ether, but insoluble in water. In the impure state it is used as a substitute for wax in making candles. (See Acidum Stearicum.) *Palmitic acid,* $C_{16}H_{32}O_2$, forms a white scaly mass, and melts at 62° C. (143. 6° F.). *Oleic acid,* $C_{18}H_{34}O_2$, is an oily liquid, insoluble in water, soluble in alcohol and ether, lighter than water, crystallizable in needles a little below 0° C. (32° F.), and having a slight smell and a pungent taste. (See Acidum Oleicum.) *Glycerin* is described under a separate head. (See Glycerinum.)

AMYGDALA DULCIS. U. S. Sweet Almond

[Amygd. Dulc.]

The ripe seeds of *Prunus Amygdalus dulcis* De Candolle (Fam. *Rosaceæ*). Preserve Sweet Almond in tightly-closed containers, adding a few drops of chloroform or carbon tetrachloride from time to time to prevent attack by insects.

Official Description.—Ovate or oblong lanceolate, 17 to 25 mm. in length, 10 to 13 mm. in breadth and 4 to 7 mm. in thickness; seed-coat light brown with numerous parallel veins, thin and easily removed on soaking the seed in water; embryo straight, white, and with two plano-convex cotyledons.

Taste.—Bland, sweet.

Tests for Identity and Purity.—*Bitter Almond.*—Triturate Sweet Almond with water; a milk-white emulsion is produced which is not acid to litmus, and has no odor of benzaldehyde or hydrocyanic acid.

The powder is creamy-white, exhibiting numerous very small oil globules, 0.001 mm. or less in diameter, and larger oil globules and crystalloids, the latter sometimes with adhering globoids; fragments of parenchyma of endosperm, containing oil globules and aleurone grains; also occasional fragments of seed-coat with characteristic, more or less scattered, large, elliptical, thin-walled, strongly lignified epidermal cells and narrow, closely spiral tracheæ. Starch grains are absent.

Sweet Almond yields not more than 4 per cent. of ash.

U. S. P. Preparation.—Emulsum Amygdalæ.

Sweet almond contains about 40 per cent. of fixed oils, protein compounds (*conglutin* and *amandin*), sugar, mucilage, etc. Tannin is present in the integuments.

The protein compounds aid in emulsionizing the fixed oil which is present, and simple trituration is all that is necessary to form a mixture.

Uses.—It is used as a demulcent in the form of an emulsion.

OLEUM AMYGDALÆ EXPRESSUM. U. S. Expressed Oil of Almond
[Ol. Amygd. Exp.—Oil of Sweet Almond]

A fixed oil obtained from the kernels of varieties of *Prunus amygdalus* Stokes (Fam. *Rosaceæ*). Preserve it in well-closed containers, in a cool place.

Preparation.—This oil is obtained equally pure from sweet and bitter almonds. The almonds having been deprived of a reddish-brown powder adhering to their surface, by being rubbed together in a piece of coarse linen, are ground in a mill, and then pressed in canvas sacks between plates of steel slightly heated. The oil, which is at first turbid, is clarified by rest and filtration. Sweet almond yields about 40 per cent. and bitter almond 35 per cent. of fixed oil.

A colorless oil may be obtained by expressing almonds which have been *blanched*—*i.e.*, deprived of their testa by soaking them in hot water and slightly pressing them, and afterwards drying in a stove to evaporate the water. The fixed oil from peach or apricot kernels is frequently sold for expressed oil of almond. While a useful product, it is not intended by the U. S. P. IX that it should be substituted for oil of sweet almond (see official test below).

Official Description.—A clear, pale straw-colored or colorless, oily liquid.

Odor and Taste.—Almost odorless, and having a bland taste.

Solubility.—Slightly soluble in alcohol, miscible with ether, chloroform, benzene, or petroleum benzin.

Specific Gravity.—0.910 to 0.915 at 25° C. (77° F.).

Tests for Identity and Purity.—*Olive or Lard Oil.*—The oil remains clear at -10° C. (14° F.), and does not congeal until cooled to nearly -20° C. (-4° F.).

Shake vigorously 2 mils of the Oil with a mixture of 1 mil of fuming nitric acid and 1 mil of water; a whitish mixture is formed, which, after standing for several hours at about 10° C., (50° F.) separates into a solid white or nearly white mass and a slightly colored liquid (*oil of peach or apricot kernels*, yielding a red color, and *sesame or cotton-seed oil* yielding a brown color).

Paraffin Oil.—Heat 10 mils of the Oil with 15 mils of an aqueous solution of sodium hydroxide (1 in 6) and 30 mils of alcohol on a water bath in a flask having a small funnel inserted in the neck, occasionally agitating the mixture until it becomes clear, then transfer the solution to a shallow dish and evaporate the alcohol on a water bath. The residue, when mixed with 100 mils of distilled water, produces a clear solution.

Various Foreign Oils.—Add an excess of hydrochloric acid to this solution; a layer of oleic acid rises to the surface, which, when separated, washed with warm water and clarified by heating on a water bath, remains clear if cooled to 15° C. (59° F.).

One volume of the oleic acid obtained in the last test, when mixed with 1 volume of alcohol, yields a clear solution, which at 15° C. (59° F.) does not deposit any fatty acids, nor become turbid upon the further addition of 1 volume of alcohol (distinction from *olive, arachis, cottonseed, sesame, or other fixed oils*).

Saponification value: not less than 191 nor more than 200 (see U. S. P., Test No. 9, Chapter LXII).

Iodine value: not less than 93 nor more than 100 (see U. S. P., Test No. 8, Chapter LXII).

U. S. P. Preparations.—Emulsum Olei Terebinthinæ; Unguentum Aquæ Rosæ.

N. F. Preparations.—Emulsum Petrolati; Oleum Phosphoratum; Unguentum Veratrinæ.

Uses.—Expressed oil of almond is used as an emollient, and also as a laxative, in doses of one fluidounce (30 mils). It is an ingredient in a number of official preparations (see above).

OLEUM OLIVÆ. U. S. Olive Oil

[Ol. Oliv.]

A fixed oil obtained from the ripe fruit of *Olea europœa* Linné (Fam. *Oleaceœ*). Preserve it in well-closed containers, in a cool place.

Preparation.—It is obtained by crushing the recently collected ripe olives in a mill without breaking the putamen, then moderately pressing the pulpy mass. This produces the highest grade oil, known as *virgin oil.* The mass in the press is then mixed with water and again expressed with greater pressure, an oil of second quality resulting. Any oil remaining in the press cake is finally extracted with carbon disulphide, or the mass is thrown into large cisterns, mixed with water, and the oil allowed to separate. A few years ago it was difficult to obtain pure olive oil, but since the passage of the Food and Drugs Act it is unusual to find original packages labeled "olive oil" which do not contain genuine olive oil. If bought in bulk or from unlabeled containers, cottonseed oil or other bland oils are commonly used as adulterants. Large quantities of olive oil are imported from Italy and other countries bordering the Mediterranean, and it is produced to a limited extent in the Southern United States, chiefly in California.

Official Description.—A pale yellow or light greenish-yellow, oily liquid.

Odor and Taste.—A slight, peculiar odor and taste, with a faintly acrid after-taste.

Solubility.—Slightly soluble in alcohol, but miscible with ether, chloroform, or carbon disulphide.

Specific Gravity.—0.910 to 0.915 at 25° C. (77° F.).

When cooled to from 10° to 8° C. (50°–46.4° F.), the Oil becomes somewhat cloudy from the separation of crystalline particles, and at 0° C. (32° F.) it usually forms a whitish, granular mass.

Cottonseed Oil.—Mix 5 mils of the Oil in a test tube with 5 mils of a mixture of equal volumes of amyl alcohol and carbon disulphide, which contains 1 per cent. of sulphur in solution, and immerse the test tube to one-third its depth in boiling, saturated aqueous salt solution, no reddish color develops in fifteen minutes.

Sesame Oil.—Mix 2 mils of the Oil with 1 mil of hydrochloric acid containing 1 per cent. of sugar, shake the mixture for half a minute and allow it to stand for five minutes; on now adding 3 mils of distilled water to the mixture and again shaking it, the acid layer shows no pink color.

Saponification value: not less than 190 nor more than 195 (see U. S. P., Test No. 9, Chapter LXII).

Iodine value: Not less than 79 nor more than 90 (see U. S. P., Test No. 8, Chapter LXII).

U. S. P. Preparation.—Emplastrum Plumbi.

N. F. Preparations.—Emplastrum Fuscum Camphoratum; Linimentum Tiglii Compositum; Oleatum Aconitinæ; Oleatum Atropinæ; Oleatum Cocainæ; Oleatum Veratrinæ; Oleum Phenolatum; Unguentum Fuscum.

Uses.—Olive oil is used in making cerates, ointment, liniments, and plasters. It is a bland, agreeable oil, well suited for emollient purposes and for food.

OLEUM GOSSYPII SEMINIS. U. S. Cottonseed Oil

[**Ol. Gossyp. Sem.**—COTTON SEED OIL]

A fixed oil obtained from seeds of cultivated varieties of *Gossypium herbaceum* Linné, or of other species of *Gossypium* (Fam. *Malvaceæ*). Preserve it in well-closed containers.

Preparation.—This oil is made commercially in the southern part of the United States upon a very large scale. The seeds contain about 15 per cent. of oil.

The testa of the seeds is first separated, and the kernels are exposed to powerful expression in hydraulic presses.

Official Description.—A pale yellow, oily liquid.

Odor and Taste.—Odorless or nearly odorless, and having a bland taste.

Solubility.—Slightly soluble in alcohol; miscible with ether, chloroform, petroleum benzin, or carbon disulphide.

Specific Gravity.—0.915 to 0.921 at 25° C. (77° F.).

Tests for Identity and Purity.—On cooling the Oil to a temperature below 12° C. (53.6° F.) particles of solid fat separate. At about 0° to -5° C. (32°–23° F.) the Oil becomes nearly or quite solid.

Add sulphuric acid (specific gravity 1.6 to 1.7) to the Oil, preferably diluted with carbon disulphide; a reddish-brown color is rapidly produced.

Mix 2 mils of the Oil in a test tube with 2 mils of a mixture of equal volumes of amyl alcohol and a 1 per cent. solution of sulphur in carbon disulphide, and immerse the test tube to one-third of its depth in a boiling, saturated aqueous solution of sodium chloride; a red color develops in from ten to fifteen minutes.

Saponification value: not less than 190 nor more than 198 (see U. S. P., Test No. 9, Chapter LXII).

Iodine value: not less than 105 nor more than 114 (see U. S. P., Test No. 8, Chapter LXII).

U. S. P. Preparations.—Linimentum Camphoræ; Sapo Mollis; Unguentum Picis Compositum.

Uses.—The official preparations are given above. It is sometimes given internally in the dose of four fluidrachms (15 mils).

OLEUM LINI. U. S. Linseed Oil

[**Ol. Lini**—OIL OF FLAXSEED RAW LINSEED OIL]

A fixed oil obtained from Linseed. Preserve it in well-stoppered containers. Linseed Oil which has been "boiled" must not be used nor dispensed.

Preparation.—The Pharmacopœia excludes oil which has been boiled, the objection to this arising from the fact that *"boiled oil"* is intended for use in paints and lead or manganese are frequently added to increase the drying property. The presence of these foreign substances renders the oil unfit for medicinal use. "Raw oil" should be ordered.

Linseed oil is a drying oil, and consists mainly of *linolin*, which, by exposure, becomes *linoxyn*, $C_{32}H_{54}O_{11}$, *myristin* and *palmitin* are also present.

Official Description.—A yellowish, oily liquid. When exposed to the air, it gradually thickens, darkens in color, and acquires a strong odor and taste.

Odor and Taste.—A peculiar odor and a bland taste.

Solubility.—Slightly soluble in alcohol, miscible with ether, chloroform, petroleum benzin, carbon disulphide, or oil of turpentine.

Specific Gravity.—0.925 to 0.935 at 25° C. (77° F.).

Tests for Identity and Purity.—*Free Acid.*—It is not more than slightly acid to litmus paper which has previously been moistened with alcohol.

Non-drying Oils.—Linseed Oil when spread in a thin layer on a glass plate and allowed to stand in a warm place is gradually converted into a hard, transparent resin.

Mineral or Rosin Oils.—To 10 mils of the Oil add 3 Gm. of potassium hydroxide, 10 mils of alcohol and 10 mils of distilled water, and heat the mixture on a water bath, with frequent agitation, until a clear solution results. The addition of 100 mils of distilled water to this solution yields a clear liquid free from oily drops.

Rosin or Rosin Oils.—Warm 2 mils of the Oil with frequent agitation in a test tube with an equal volume of glacial acetic acid, and, after cooling, add to the mixture 1 drop of sulphuric acid. A greenish color is produced (a violet color under these circumstances indicates the presence of *rosin or rosin oils*).

Saponification value: not less than 187 nor more than 195 (see U. S. P., Test No. 9, Chapter LXII).

Iodine value: not less than 170 (see U. S. P., Test No. 8, Chapter LXII).

U. S. P. Preparations.—Linimentum Calcis; Liquor Cresolis Compositus.

N. F. Preparations.—Ceratum Resinæ Compositum; Pasta Zinci Mollis; Petroxolinum Sulphuratum; Petroxolinum Sulphuratum Compositum.

Uses.—Linseed oil is used as a laxative, in doses of one to two fluidounces (30 to 60 mils) and in the official preparations named above.

PEPO. U. S. Pepo

[PUMPKIN SEED]

The dried ripe seeds of cultivated varieties of *Cucurbita Pepo* Linné (Fam. *Cucurbitaceæ*), without the presence or admixture of more than 5 per cent. of other substances.

Official Description.—Broadly elliptical or ovate, from 15 to 23 mm. in length and from 2 to 3 mm. in thickness; externally yellowish-white, very smooth, occasionally with thin, transparent fragments of adhering pulp and with a shallow groove parallel to and within 1 mm. of the margin; fracture short, seed-coat consisting of a white coriaceous outer layer and a membranous inner layer occasionally of a dark green color; embryo whitish, straight, with a small conical hypocotyl and two plano-convex cotyledons.

Odor and Taste.—Slightly odorous when contused; taste bland and oily.

Tests for Identity and Purity.—Under the microscope, sections of Pepo show an outer epidermal layer consisting of palisade-like cells, the radial walls attaining a length of 1 mm., the outer walls being usually torn off so that it appears as though the seeds were covered with very long hairs; a sub-epidermal layer consisting of from 5 to 12 rows of cells with slightly thickened, lignified and porous walls; a layer of strongly lignified stone cells, elliptical in outline and about 0.075 mm. in length; a single layer of small cells resembling those of the sub-epidermal layer; several rows of parenchyma cells with characteristic reticulate markings and separated from each other by large intercellular spaces; several layers of parenchyma cells, the inner layer being more or less collapsed and bounded on the inside by a single epidermal layer, the cells having rather thick walls; the perisperm cells are usually more or less collapsed and the endosperm consists of a single layer of cells filled with small aleurone grains; the cotyledons consist of thin-walled, isodiametric, elongated or palisade-like cells containing a fixed oil and numerous small aleurone grains.

Uses.—This seed contains about 40 per cent. of fixed oil, starch, protein compounds, a little acrid resin, sugar, etc. Pumpkin seed is used as a tænifuge by beating the kernels with water and adding sugar so as to make a mixture like almond mixture; a better method, however, is to emulsify the fixed oil, which is now an article of commerce, and made by percolating the ground seeds with ether. Dose, of the seed, one ounce (31 Gm.).

OLEUM RICINI. U. S. Castor Oil

[Ol. Ricin.]

A fixed oil obtained from the seeds of *Ricinus communis* Linné (Fam. *Euphorbiaceæ*). Preserve it in well-closed containers.

Preparation.—Castor oil has been obtained from the seed in four ways. 1. By cold expression. 2. By expression with heat. 3. By percolation with alcohol. 4. By decoction. The first method produces the best oil; a powerful hydraulic press (see page 276) is generally used, and the oil clarified by subsidence. It contains *ricinolein* and palmitin. The purgative action is supposed to be due to the presence of two principles *ricin*, an unorganized ferment related to the toxalbumins and *ricinine*, $C_8H_8N_2O_2$, a poisonous base, precipitated from solution by mercuric chloride solution and Wagner's reagent. Other alkaloidal reagents do not affect it. A given weight of the seeds is more active than the same quantity of oil.

Official Description.—A pale yellowish or almost colorless, transparent, viscid liquid.

Odor and Taste.—A faint, mild odor, and a bland, afterwards slightly acrid and generally nauseating taste.

Miscibility.—Miscible with dehydrated alcohol or glacial acetic acid.

Specific Gravity.—0.945 to 0.965 at 25° C. (77° F.).

Tests for Identity and Purity.—Only partly soluble in petroleum benzin (distinction from *most other fixed oils*).

Foreign Oils.—Castor Oil produces a clear liquid with an equal volume of alcohol.

Saponification value: not less than 179 nor more than 185 (see U. S. P., Test No. 9, Chapter LXII).

Iodine value: not less than 83 nor more than 88 (see U. S. P., Test No. 8, Chapter LXII).

U. S. P. Preparation.—Collodium Flexile.

N. F. Preparations.—Emulsum Olei Ricini; Oleum Ricini Aromaticum; Pilulæ Antimonii Compositæ.

Uses.—Castor oil is used as a purgative, in doses of one-half to one fluidounce (15 to 30 mils).

OLEUM SESAMI. U. S. Sesame Oil

[Ol. Sesam.—TEEL OIL BENNE OIL]

A fixed oil obtained from the seeds of one or more cultivated varieties of *Sesamum indicum* Linné (Fam. *Pedaliaceæ*). Preserve it in well-closed containers.

Preparation.—It is obtained by subjecting benne seeds to pressure, the yield being about 50 per cent. The best grade of oil is the cold pressed.

Official Description.—A pale yellow, oily liquid.

Odor and Taste.—Almost odorless, and having a bland taste.

Solubility.—Slightly soluble in alcohol, miscible with ether, chloroform, petroleum benzin, or carbon disulphide.

Specific Gravity.—0.916 to 0.921 at 25° C. (77° F.).

Tests for Identity and Purity.—Shake 1 mil of the Oil for half a minute with a solution of 0.1 Gm. of sugar in 10 mils of hydrochloric acid; the acid layer becomes bright red and changes to dark red on standing.

Free Acid.—Blue litmus paper previously moistened with alcohol is not more than slightly reddened by 2 mils of the Oil.

Cottonseed Oil.—Mix 5 mils of the Oil in a test tube with 5 mils of a mixture of equal volumes of amyl alcohol and a 1 per cent. solution of sulphur in carbon disulphide and immerse the test tube to one-third of its depth in a boiling saturated aqueous solution of sodium chloride; no reddish color develops in fifteen minutes.

Saponification value: not less than 188 nor more than 193 (see U. S. P., Test No. 9, Chapter LXII).

Iodine value: not less than 103 nor more than 112 (see U. S. P., Test No. 8, Chapter LXII).

U. S. P. Preparation.—Linimentum Ammoniæ.

N. F. Preparation.—Olea Infusa.

Uses.—Used much like olive oil both medicinally and for food. It replaces cottonseed oil in ammonia liniment in the U. S. P. IX as it saponifies more readily and produces a more permanent and less sticky emulsion.

OLEUM TIGLII. U. S. Croton Oil
[Ol. Tiglii]

A fixed oil expressed from the seeds of *Croton Tiglium* Linné (Fam. *Euphorbiaceæ*). Preserve it in small, well-stoppered bottles protected from light.

Preparation.—Croton oil is prepared by expression or by percolating the ground seeds with carbon disulphide and distilling the percolate. Neither the purgative principle nor the vesicating principle has been isolated; by the decomposition of the fatty substances present, tiglinic, valeric, formic, acetic, myristic, stearic, isobutyric, lauric, and palmitic acids have been detected; *Croton-resin*, $C_{13}H_{18}O_4$, is said to be present.

Official Description.—A pale yellow or brownish-yellow, somewhat viscid and slightly fluorescent liquid.

Odor, Taste, and Reaction.—A slight, characteristic odor. *Great caution is necessary in tasting it.* It must be handled carefully as it causes a pustular eruption, when applied to the skin. It is acid to litmus paper previously moistened with alcohol.

Solubility.—Slightly soluble in alcohol, the solubility increasing with age; freely soluble in ether, chloroform, or in fixed or volatile oils.

Specific Gravity.—0.935 to 0.950 at 25° C. (77° F.).

Tests for Identity and Purity.—When gently heated with twice its volume of dehydrated alcohol, it forms a clear solution from which the Croton Oil separates, either partially or completely on cooling.

Add 1 mil each of fuming nitric acid and of distilled water to 2 mils of the Oil, and shake the mixture vigorously for a few minutes; it does not solidify either completely or partially after standing for twenty-four hours.

Saponification value: not less than 200 nor more than 215 (see U. S. P., Test No. 9, Chapter LXII).

Iodine value: not less than 104 nor more than 110 (see U. S. P., Test No. 8, Chapter LXII).

N. F. Preparations.—Collodium Tiglii; Linimentum Tiglii; Linimentum Tiglii Compositum; Pilulæ Aloes, Hydrargyri et Scammonii Compositæ.

Uses.—Internally in doses of one minim (0.06 mil), croton oil is a powerful purgative; externally, when applied to the skin, it is rubefacient and vesicant.

OLEUM THEOBROMATIS. U. S. Oil of Theobroma
[Ol. Theobrom.—BUTTER OF CACAO CACAO BUTTER]

A concrete fixed oil obtained from the roasted seeds of *Theobroma Cacao* Linné (Fam. *Sterculiaceæ*).

Preparation.—This is made by expressing the kernels of the "chocolate nut" between hot iron plates, and running the product into molds. The yield is about 40 per cent. Chemically, it is a mixture of stearin, palmitin, olein, arachin, and laurin, and, owing to its low fusing point, and its property of becoming solid at a temperature just below the fusing point, it is valuable in pharmacy in making suppositories. (See Suppositoria.)

Official Description.—A yellowish-white solid.

Odor and Taste.—A faint, agreeable odor, and a bland, chocolate-like taste.

Solubility.—Usually brittle at temperatures below 25° C. (77° F.). Slightly soluble in alcohol, soluble in boiling dehydrated alcohol, and freely soluble in ether, chloroform, or benzene.

Specific Gravity.—About 0.973 at 25° C. (77° F.).

Tests for Identity and Purity.—It melts between 30° and 35° C. (86° and 95° F.).

Wax, Stearin, or Tallow.—Dissolve 1 Gm. of Oil of Theobroma in 3 mils of ether in a test tube at a temperature of 17° C. (62.6°F.) and immerse the tube into water having the temperature of melting ice. The liquid does not become turbid nor deposit white flakes in less than three minutes; and if the mixture after congealing is again brought to 15° C. (59° F.), it gradually forms a perfectly clear liquid.

Saponification value: not less than 188 nor more than 195 (see U. S. P., Test No. 9, Chapter LXII).

Iodine value: not less than 33 nor more than 38 (see U. S. P., Test No. 8, Chapter LXII).

N. F. Preparation.—Trochisci Quininæ Tannatis.

Uses.—In addition to its use as a vehicle for suppositories, butter of cacao is an excellent emollient application to the skin when inflamed. It is also used in massage.

CACAO PRÆPARATA. N. F. Cocoa
[Cacao Præp.—PREPARED CACAO]

A powder prepared from the roasted, cured kernels of the ripe seeds of *Theobroma Cacao* Linné and of other species of *Theobroma* (Fam. *Sterculiaceæ*), deprived of a portion of its fat.

Official Description.—A brownish powder.

Odor and Taste.—A chocolate-like odor and taste, free from sweetness.

Tests for Identity and Purity.—Extracted with cold water, Cocoa yields not less than 14 per cent. nor more than 22 per cent. of soluble matter.

Extracted with ether, Cocoa yields not less than 18 per cent. of fat, and the fatty residue does not have a spicy odor or taste.

The residue, insoluble in ether, when examined under the microscope, shows not more than 3 per cent. of Cocoa shells, and no foreign starch granules or other foreign substances.

Cocoa contains not more than 6 per cent. of crude fiber and not more than 12 per cent. of starch.

Cocoa yields not less than 3.5 per cent. nor more than 8 per cent. of ash, which has a distinctly reddish color.

N. F. Preparations.—Trochisci Quininæ Tannatis; Trochisci Santonini; Trochisci Santonini Compositi.

Uses.—It is used as a food and pharmaceutically as a flavor in tablets, syrups, pill coating, troches, etc.

LYCOPODIUM. U. S. Lycopodium
[Lycopod.]

The spores of *Lycopodium clavatum* Linné (Fam. *Lycopodiaceæ*), without the presence or admixture of more than 2 per cent. of impurities.

Official Description.—A light yellow, very mobile powder. It is not wetted by water but floats upon it; when boiled with water it sinks; when thrown into a flame it burns with a quick flash.

Odor and Taste.—Nearly inodorous and tasteless.

Tests for Identity and Purity.—Under the microscope, the spores of Lycopodium are spherical tetrahedrons, from 0.025 to 0.04 mm. in diameter; in section they vary from plano-convex to triangular, the outer wall or exosporium being extended in the form of slight, irregular projections, giving the surface of the spore a reticulate appearance, the reticulations being polygonal and formed of straight sides; when viewed so that the rounded surface of the spores is on the under side, the upper surface is characterized by a distinct, triangular marking, being the edges of the three straight surfaces, extending from the center of the spores to near the outer edge.

Lycopodium shows very few, if any, pollen grains of species of Pine, the latter being from 0.04 to 0.07 mm. in diameter, and consisting of three parts, in which a central, convex, generative cell separates the two spherical cells or wings which are blackish, due to the inclusion of air.

Lycopodium yields not more than 3 per cent. of ash.

Uses.—Lycopodium contains 47 per cent. of fixed oil, with minute quantities of volatile bases. It is used as a dusting powder for suppositories, and to allay irritation of the skin through chafing, and for similar purposes.

Unofficial Fixed Oils.

Oil of Bassia	From *Bassia longifolia*. Fam. Sapotaceæ. A greenish oil is expressed from the seeds
Bayberry	From *Myrica cerifera*. Fam. Myricaceæ. Habitat, North America. The oil and wax are prepared by boiling the fruit with water until the oil collects on the surface. The yield of oil is about 30 per cent.
Beech	From the fruit of *Fagus sylvatica*. Fam. Cupuliferæ. Habitat, Europe. It is of a yellow color and mild odor and taste. The yield of oil is about 20 per cent.
Behen	From the fruit of *Moringa aptera*. Used in ointments and pomades
Ben	A fixed oil from the seeds of *Moringa pterygosperma*. Used for the same purposes as olive oil
Black Mustard	From the seed of *Brassica nigra* (Linné) Koch. Fam. Cruciferæ. Habitat, Europe. A yellow or brownish-yellow fixed oil. Sp. gr. 0.916. The yield of oil is about 20 per cent.
Brazil Nut	From the seed of *Bertholletia excelsa*. Fam. Lecythidaceæ. Habitat, Brazil. It is a pale yellow, bland oil. The yield of oil is about 50 per cent.
Candle Nut	From *Aleurites triloba*. Habitat, islands of the Pacific Ocean. The yield of oil is about 60 per cent.
Cardamom	From the fruit of *Elettaria repens*. Fam. Zingiberaceæ. The yield of oil is about 10 per cent.
Chaulmoogra Br. 1914	From the seed of *Taraktogenos Kurzii*, King. Prepared by subjecting the seeds to pressure and collecting the oil. It is not identical with the oil from *Gynocardia odorata* which is sometimes sold for this oil. It is supposed to have special value in the treatment of leprosy. Administered in capsules, in emulsion, by the rectum, and through an ointment
Coco-nut	From *Cocus nucifera*. Fam. Palmæ. Habitat, tropical countries. Prepared by boiling the seeds with water and expressing. It is of a butyraceous consistence, white, and has a peculiar odor and a bland taste
Crab	From *Carapa guianensis*. Prepared by expressing the seed
Cucumber Seed	From the seed of *Cucumis sativus*. Fam. Cucurbitaceæ. Habitat, Central Asia
Ergot	From *Claviceps purpurea*. The yield of oil is about 25 per cent.
Groundnut	From the kernels of the fruit of *Arachis hypogæa*. Prepared by expression
Hazelnut	From *Corylus avellana*. Fam. Cupuliferæ. Habitat, Europe. The yield of oil is about 50 per cent.
Hemp Seed	From the seed of *Cannabis sativa*. Fam. Urticaceæ. Habitat, Europe and North America. The yield of oil is about 30 per cent.
Horsechestnut	From the kernels of the fruit of *Æsculus hippocastanum*. Fam. Sapindaceæ. The yield of oil is about $^1/_{10}$ per cent.
Hydrastis	From *Hydrastis canadensis*. Fam. Ranunculaceæ. Habitat, United States
Hyoscyamus Seed	From the seed of *Hyoscyamus niger*. Fam. Solanaceæ. Habitat, Europe. The yield of oil is about 25 per cent.
Juglans	From *Juglans cinera*. Fam. Juglandaceæ. Habitat, United States. The yield of oil is about 15 per cent.

Unofficial Fixed Oils.—*Continued.*

Oil of Kurung	From *Pongamia glabra*. Fam. Leguminosæ. Habitat, India. It is a thickish, yellow oil, of sp. gr. 0.945
Larkspur Seed	From the seed of *Delphinium Consolida*. Fam. Ranunculaceæ. Habitat, Central Europe
Laurel	From *Laurus nobilis*. Fam. Lauraceæ. Habitat, Europe. Prepared by steeping the fruit in hot water and expressing
Mace	From the arillus of the fruit of *Myristica fragrans*. Fam. Myristicaceæ. Habitat, Molucca Islands
Madia	From *Madia sativa*. Fam. Compositæ. Habitat, Europe. The yield of oil is about 40 per cent.
Mangosteen	From *Garcinia indica*. Fam. Guttiferæ. Habitat, India. The yield of oil is about 30 per cent.
Melon Seed	From *Cucumis Melo*. Fam. Cucurbitaceæ. Habitat, Central Asia
Nicker Seed	From *Cæsalpinia Bunducella*. Fam. Leguminosæ
Nigella	From the seed of *Nigella sativa*. Fam. Ranunculaceæ. Habitat, Southern Europe. The yield of oil is about 35 per cent.
Niger Seed	From *Guizotia oleifera*. Fam. Compositæ. Habitat, India. The yield of oil is about 40 per cent.
Nutmeg	From the kernel of the seed of *Myristica fragrans*. Fam. Myristicaceæ. Habitat, Molucca Islands. The yield of oil is about 22 per cent.
Palm	From the fruit of *Elæis guineensis*. Fam. Palmæ. Habitat, West Africa. Sp. gr. 0.945
Peach	From *Persica vulgaris*. Fam. Rosaceæ. The oil resembles expressed oil of almond
Poppy Seed	From the seed of *Papaver somniferum*. Fam. Papaveraceæ. Habitat, Asia and Europe. It is of a yellow color, bland, and limpid. The yield is about 45 to 50 per cent.
Pumpkin Seed	From the seed of *Cucurbita Pepo*. Fam. Cucurbitaceæ. Habitat, Asia and Europe. The yield of oil is about 45 per cent.
Purging Nut	From the seed of *Curcas purgans*. Fam. Euphorbiaceæ. Habitat, West Indies. The yield is about 35 per cent.
Rape Seed	From *Brassica campestris*. A fixed oil used for making green soft soap
Staphisagria	From the seed of *Delphinium Staphisagria*. Fam. Ranunculaceæ. Habitat, Europe. The yield of oil is about 30 per cent.
Stramonium Seed	From the seed of *Datura Stramonium*. Fam. Solanaceæ. Habitat, United States. The yield of oil is about 25 per cent.
Tonka	From the seed of *Dipterix odorata*. Fam. Leguminosæ. Habitat, Guiana. An odorous fixed oil. The beans contain coumarin. Used for flavoring. Narcotic. Used in whooping cough, in doses of five to eight grains (0.32 to 0.5 Gm.), given in the form of fluidextract
Tucom	From the fruit of *Astrocaryum vulgare*. Habitat, South America. It has a bright red color and an agreeable odor
Watermelon Seed	From the seed of *Cucurbita Citrullus*. Fam. Cucurbitaceæ. Habitat, Southern Asia. The yield is about 30 per cent.
White Mustard	From the seed of *Sinapis Alba*. Fam. Cruciferæ. Habitat, Asia. The yield of oil is about 20 per cent.

ACIDUM OLEICUM. U. S. Oleic Acid
[Acid. Oleic.]

An acid obtained from fats, consisting chiefly of $C_{18}H_{34}O_2$ or $C_{17}H_{33}.COOH$ (282.27). Preserve it in well-closed glass or stoneware containers, in a cool place.

Preparation.—Oleic acid is generally obtained as a by-product in the manufacture of candles from fats, stearic and palmitic acids being the fatty substances sought for by the makers. The crude oleic acid is known as "red oil," the stearic and palmitic acids being separated by cooling the mixture and filtering.

Official Description.—A yellowish or brownish-yellow, oily liquid. It becomes darker and absorbs oxygen on exposure to air.

Odor and Taste.—A peculiar, lard-like odor and taste free from rancidity.

Solubility.—Practically insoluble in water; slightly soluble in 60 per cent. alcohol (by volume), the solubility very rapidly increasing in stronger alcohol; it is completely miscible with about 85 per cent. alcohol (by volume); it is also soluble in chloroform, benzene, petroleum benzin, or in fixed or volatile oils.

Specific Gravity.—About 0.895 at 25° C. (77° F.).

Tests for Identity and Purity.—When gradually cooled, Oleic Acid does not become semi-solid above 9° C. (48.2° F.); on further cooling, it congeals to a whitish, solid mass at about 4° C. (39.2° F.).

When heated to a temperature of about 95° C. (203° F.), decomposition commences and acrid vapors are produced.

Incinerate 5 mils of Oleic Acid; not more than 0.005 Gm. of ash remains.

Mineral Acids.—Shake Oleic Acid with an equal volume of distilled water; the separated water after filtration is not reddened by the addition of a drop of methyl orange T.S.

Undecomposed Fat or Mineral Oil.—Boil about 1 Gm. of Oleic Acid and about 0.5 Gm. of monohydrated sodium carbonate with 30 mils of distilled water in a capacious flask; the resulting solution while hot is clear or at most opalescent.

U. S. P. Preparation.—Oleatum Hydrargyri.

N. F. Preparations.—Oleatum Aconitinæ; Oleatum Atropinæ; Oleatum Cocainæ; Oleatum Quininæ; Oleatum Veratrinæ; Petroxolinum Creosoti; Petroxolinum Guaiacolis; Petroxolinum Hydrargyri; Petroxolinum Iodi; Petroxolinum Iodoformi; Petroxolinum Liquidum; Petroxolinum Spissum; Petroxolinum Sulphuratum.

Uses.—Oleic acid is used as the basis for the oleates, a number of which are official (see page 437). The oleates are very useful external remedies; they are used in various skin diseases, and also for communicating the constitutional effects of numerous remedies. Oleic acid is more quickly absorbed by the skin than any other similar vehicle.

Unofficial Oleates

Aluminum Oleate, $Al(C_{18}H_{33}O_2)_3$	By decomposing sodium oleate with aluminum sulphate. It is a semi-solid, of a dark brown color, and has a decidedly astringent action. Used in treating burns, scalds, foul ulcers, etc.
Silver Oleate, $AgC_{18}H_{33}O_2$	By precipitating sodium oleate with a saturated solution of silver nitrate, washing the precipitate with boiling water, drying it, and reducing to a fine powder. It is of a brownish-yellow color. Used externally
Arsenic Oleate, $As(C_{18}H_{33}O_2)_3$	By first preparing arsenous chloride by treating metallic arsenic with hydrochloric acid, and then adding sodium oleate and collecting the precipitate. It is of a yellowish color and has the consistence of butter
Bismuth Oleate, $Bi(C_{18}H_{33}O_2)_3$	By dissolving *crystallized* bismuth nitrate in glycerin, then diluting sodium oleate with water and adding the bismuth solution to the sodium mixture, warming, rejecting the aqueous layer, and, lastly, washing several times with warm water. It is of a white or a yellowish-white color, and has about the consistence of an ointment
Copper Oleate, $Cu(C_{18}H_{33}O_2)_2$	By adding sodium oleate to a saturated solution of copper sulphate, then washing the precipitate. It is a handsome, dark green, waxy solid. Used chiefly in the treatment for ringworm
Iron Oleate (Ferric), $Fe(C_{18}H_{33}O_2)_3$	By adding sodium oleate to a solution of ferrous sulphate and *boiling.* It is a dark red, soft, solid oleate. Used locally
Manganese Oleate	By adding to a solution of sodium oleate a solution of manganese sulphate, heating gently, and collecting the precipitate. It is of a light gray, slightly pinkish color, having a peculiar odor
Mercury and Morphine Oleate	By combining with a gentle heat 40 parts mercuric oleate, 3 parts morphine, and 13 parts oleic acid. It forms a very dark brown, soft solid
Nickel Oleate	By adding sodium oleate to a solution of nickel sulphate and collecting the precipitate. It is a green, amorphous, waxy substance. Used locally as an astringent
Sodium Oleate	By dissolving 1 part of pure Castile soap in 8 parts of hot water, cooling, and filtering from deposited sodium palmitate. The filtrate contains sodium oleate
Sodium Oleate, Acid, $NaC_{18}H_{33}O_2$	Contains an excess of oleic acid. Yellow, fatty granules. Used in biliary lithiasis
Tin Oleate	By adding a solution of tin chloride to a solution of sodium oleate and collecting the precipitate. It has a grayish-yellow color, a soft consistence, and a decided metallic taste

ACIDUM STEARICUM. U. S. Stearic Acid

[Acid. Stear.]

An acid obtained from tallow and other solid fats, consisting chiefly of $C_{18}H_{36}O_2$ or $C_{17}H_{35}.COOH$ (284.29).

Preparation.—It is usually prepared from tallow and similar fats by boiling them with soda lye, separating the glycerin and decomposing the sodium stearate with sulphuric or hydrochloric acid. It is also prepared by the hydrogenation of oleins, (see page 1236). It may be purified by dissolving in hot alcohol when, upon cooling, the acid separates.

Official Description.—A hard, white, or yellowish-white, somewhat glossy solid; permanent in the air.

Odor and Taste.—Odorless, or having a slight, tallow-like odor, tasteless.

Solubility.—One Gm. of Stearic Acid dissolves in 21 mils of alcohol, 2 mils of chloroform, or in 3 mils of ether at 25° C. (77° F.); almost insoluble in water; freely soluble in carbon disulphide or carbon tetrachloride.

Tests for Identity and Purity.—Melting point: not below 56° C. (132.8 °F.).

Congealing point: not below 54° C. (129.2° F.).

Incinerate about 1 Gm. of Stearic Acid; not more than 0.1 per cent. of ash remains.

Undecomposed Fat or Paraffin.—Boil about 1 Gm. of Stearic Acid and about 0.5 Gm. of monohydrated sodium carbonate with 30 mils of distilled water in a capacious flask; the resulting solution while hot is not more than opalescent.

Mineral Acids.—Shake melted Stearic Acid with an equal volume of hot distilled water; the separated water, after filtration, is not reddened by the addition of a drop of methyl orange T.S.

U. S. P. Preparation.—Suppositoria Glycerini.

N. F. Preparation.—Linimentum Saponato-Camphoratum.

Uses.—Pharmaceutically its chief use is in the preparation of sodium stearate which is the solidifying agent for the official glycerin suppositories and also in many other commercial products, such as toilet creams, solidified alcohol (see page 121), solidified smelling salts, etc.

GLYCERINUM. U. S. Glycerin

[**Glycerin.**—GLYCEROL]

A liquid obtained by the hydrolysis of vegetable or animal fats, or fixed oils, purified by distillation, and containing not less than 95 per cent. of the trihydric alcohol $C_3H_5(OH)_3$ or $CH_2OH.CHOH.CH_2OH$ (92.06). Preserve it in well-closed containers.

Preparation.—This valuable liquid has been made in several ways: 1. Through the saponification of fats and oils in making soap or lead plaster. 2. By the decomposition of fats and oils through pressure and superheated steam. 3. It has also been prepared synthetically, one method being the heating of trichlorpropane with water, at a temperature of 180° C. (356° F.), whereby glycerin is produced. Glycerin came into use in medicine and pharmacy about 1846, and it was first obtained on a commercial scale from the washings of lead plaster by Robert Shoemaker, of Philadelphia. In making the plaster, litharge, olive oil, and water are boiled together, when the olein of the oil is decomposed by the lead oxide, according to the following reaction:

$$\underset{\substack{\text{Glyceryl Oleate}\\\text{(Olive Oil)}}}{2C_3H_5 3C_{18}H_{33}O_2} + \underset{\substack{\text{Lead}\\\text{Oxide}}}{3PbO} + \underset{\text{Water}}{3H_2O} = \underset{\substack{\text{Lead Oleate (Lead}\\\text{Plaster)}}}{3Pb2C_{18}H_{33}O_2} + \underset{\substack{\text{Glycerin Hydroxide}\\\text{(Glycerin)}}}{2C_3H_5 3OH}$$

The process most frequently used for making glycerin originated with R. A. Tilghman, of Philadelphia, and consists in subjecting fatty bodies to the action of water at a high temperature under pressure, whereby the fats, which are *glycerides* or esters of the fatty acids, are broken up into glycerin and fatty acids, the water supplying the elements of hydrogen and oxygen necessary to the change. The reaction is as follows in the case of a fat like stearin:

$$\underset{\text{Stearin}}{C_3H_5 3C_{18}H_{35}O_2} + \underset{\text{Water}}{3H_2O} = \underset{\text{Glycerin}}{C_3H_5(OH)_3} + \underset{\text{Stearic Acid}}{3HC_{18}H_{35}O_2}$$

Chemically, glycerin belongs to the class of alcohols, and is sometimes termed *glycerol*, or *glyceric alcohol.* It is the hydroxide of the radical glyceryl C_3H_5, is triatomic, and one, two, or three of the hydrogen atoms may be replaced by monad radicals.

Official Description.—A clear, colorless liquid, of a thick, syrupy consistence; when exposed to the air, it absorbs moisture.

Odor, Taste, and Reaction.—Not more than a slight, characteristic odor which is neither harsh nor disagreeable, sweet to the taste and producing a sensation of warmth in the mouth. An aqueous solution of Glycerin (1 in 20) is neutral to litmus.

Solubility.—Glycerin is miscible with water or alcohol; insoluble in chloroform, ether, benzene, petroleum benzin, carbon disulphide or fixed or volatile oils.

Specific Gravity.—Not below 1.249 at 25° C. (77° F.).

Tests for Identity.—Glycerin does not appreciably volatilize from weak aqueous solutions. When of a strength between 70 and 100 per cent., it rapidly volatilizes at 100° C. (212° F.).

Heat a few drops of Glycerin with about 0.5 Gm. of potassium bisulphate; pungent vapors of acrolein are evolved.

Glycerin is colorless when viewed transversely in a tube of colorless glass about 30 mm. in diameter, held in a vertical position.

Impurities and Tests for Impurities.—Heat 50 Gm. of Glycerin in an open, shallow, 100 mil porcelain or platinum dish until it ignites, then allow it to burn without further application of heat in a place free from draught; not more than 0.015 per cent. of carbonaceous and mineral residue remains. Subject this residue to a low red heat, until combustion is complete; not more than 0.007 per cent. of mineral ash remains. This ash, when dissolved in 10 mils of distilled water and titrated with hundredth-normal silver nitrate V.S., using potassium chromate T.S. as indicator, shows, in the original 50 Gm. of Glycerin, not more than 0.001 per cent. of chlorides calculated as sodium chloride. Each mil of hundredth-normal silver nitrate V.S. consumed corresponds to 0.0005846 Gm. of NaCl.

Readily Carbonizable Impurities.—Mix 5 mils of Glycerin by vigorous shaking with an equal volume of sulphuric acid in a glass-stoppered cylinder; the liquid does not become darker than yellow on standing for one hour.

Fatty Acids and Esters.—Mix 50 Gm. of Glycerin with 50 mils of freshly boiled distilled water and 5 mils of half-normal potassium hydroxide V.S. and boil the mixture for five minutes. When cold, it requires not less than 4 mils of half-normal hydrochloric acid V.S. for neutralization, using phenolphthalein T.S. as indicator.

Oxalic Acid.—An aqueous solution of Glycerin (1 in 10) remains clear on the addition of calcium chloride T.S.

Sulphate.—Another portion of the solution is not affected by barium chloride T.S. after acidulation with a few drops of diluted hydrochloric acid.

Heavy Metals.—An aqueous solution of Glycerin does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Arsenic.—An aqueous solution of Glycerin meets the requirements of the Test for arsenic (see U. S. P., Test No. 1, Chapter LXII).

Acrolein, Glucose.—A mixture of 5 mils of Glycerin and 5 mils of an aqueous solution of potassium hydroxide (1 in 10) does not become yellow when kept for five minutes at 60° C. (140° F.),

Ammonium Compounds.—Nor emit an odor of ammonia.

U. S. P. Preparations.—Gelatinum Glycerinatum; Glycerites; Fluidextracts; Liquor Ferri et Ammonii Acetatis; Massa Hydrargyri; Mel Depuratum; Mucilago Tragacanthæ; Pilulæ Ferri Carbonatis; Pilulæ Phosphori; Suppositoria Glycerini; Syrupus Calcii Lactophosphatum; Syrupus Hypophosphitum; Syrupus Ipecacuanhæ; Syrupus Lactucarii; Syrupus Pruni Virginianæ; Tinctures; Tinctura Lactucarii; Unguentum Acidi Tannici; Unguentum Iodi.

N. F. Preparations.—Cataplasma Kaolini; Elixir Bismuthi; Elixir Calcii et Sodii Glycerophosphatum; Extractum Conii; Glycerites; Fluidextracts; Fluidglycerates; Tinctures, etc.; Gelatinum Boroglycerini.

Uses.—Glycerin is one of the most valuable liquids known to pharmacy. It is solvent and antiseptic, scarcely inferior to alcohol. When glycerin is acted on by nitric acid, nitroglycerin, a powerful explosive, is formed. This is used in the preparation of dynamite and other high explosives; it is sometimes called *glonoin* and *trinitrine.* A 1 per cent. alcoholic solution is official (see Spiritus Glycerylis Nitratis, page 389). Glycerin is useful in keeping substances moist, owing to its tendency to absorb water from the air. Its agreeable taste and nonpoisonous properties adapt it for many purposes. Its varied uses have been constantly referred to in the preceding pages.

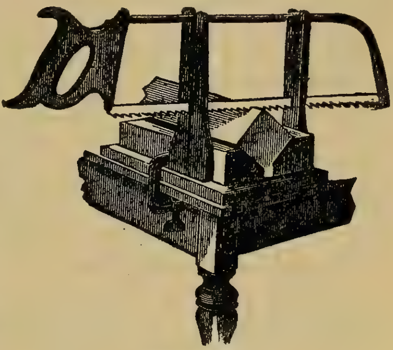
SAPO. U. S. Soap

[WHITE CASTILE SOAP]

Soap prepared from olive oil and sodium hydroxide. Preserve dried or powdered Soap in well-closed containers.

Preparation.—Soap is made by boiling fats or oils with a solution of caustic alkali until a thick mass is formed. Then, by evaporating the water, or by adding solution of common salt, the soap is separated and caused to rise to the surface; when it has ceased to froth in boiling, it is ladled out into wooden frames to congeal, after which it is cut into bars by means of a wire. The soap, as first separated, is called *grain soap*. Fig. 451 shows a useful soap cutter made by the Woodward Lock Company, Clinton, Wisconsin. The "soap dust" and clippings from Castile soap are a very convenient form for use in making soap liniment, etc. A convenient and inexpensive grater is available for reducing soap shavings to [a granular powder. The soap is placed in a hopper, a block of wood placed on top, and the grater, which is cylindrical, is revolved by a handle. This apparatus may also be used for grating *Cacao Butter*. It may be purchased from stores where kitchen supplies are sold. Toilet soaps are made by *milling* grain soap, or cutting it into small pieces; perfume is then added, thoroughly mixed, and the mixture forced by a plotting machine through an aperture, which forms it into rolls and cuts it into pieces. These are then moulded.

FIG. 451



Soap cutter

The official soap is known as Castile soap. The soaps in general use are made from animal fat, chiefly tallow. Soaps are made hard by using a fat containing much stearin, like tallow, and sodium hydroxide for the alkali; they are made soft by using fats containing a large portion of olein, and potassium hydroxide for the alkali. When fats and oils undergo *saponification* by reaction with a salifiable base, the olein, palmitin, and stearin present are decomposed into stearic, palmitic, and oleic acids, which unite with the base to form the soap, and into the glycerin, which is set free.

Soaps are divided into two classes, soluble and insoluble. The soluble soaps are combinations of the fatty acids with sodium or potassium hydroxide or ammonia; those which are insoluble consist of the same acids united with earths and metallic oxides. The soluble soaps only are detergent, and to these the name *soap* is usually applied. Several of the insoluble soaps are employed in pharmacy, as, for example, the soap of lead monoxide (litharge), or lead plaster, and the soap of lime, or lime liniment. (See Emplastrum Plumbi and Linimentum Calcis). The two official soaps are of the soluble kind. One is a soda soap, made with olive oil (Castile soap), the other a potash soap (Sapo Viridis). The soap of ammonia is noticed elsewhere. (See Linimentum Ammoniæ).

Official Description.—A white or whitish solid, in the form of bars, hard, yet easily cut when fresh, or as a fine, yellowish-white powder.

Odor, Taste, and Reaction..—A faint, peculiar odor, free from rancidity, and a disagreeable, alkaline taste. Its aqueous solution is alkaline to litmus.

Solubility.—Soluble in water and in alcohol, more readily, however, with the aid of heat.

Tests for Identity and Purity.—*Water.*—Dissolve about 0.5 Gm. of Soap, accurately weighed, in 10 mils of alcohol, evaporate the mixture to dryness in a tared beaker containing 1 Gm. of clean sand, which has been previously dried at 110° C. (230° F.) Dry the residue at 110° C. (230° F.) to constant weight. The loss does not exceed 36 per cent. for unpowdered Soap or 10 per cent. for powdered Soap.

Soap from Animal Fats.—A solution of a quantity of Soap corresponding to 0.64 Gm. of dried Soap in 25 mils of hot alcohol does not gelatinize on cooling to 20° C. (68° F.).

Metallic Impurities.—Ten mils of an aqueous solution of Soap (1 in 20) remains unchanged in color upon the addition of ammonium sulphide T.S., and upon acidulating another portion of 10 mils of the solution with hydrochloric acid and filtering, the filtrate remains unchanged in color when an equal volume of hydrogen sulphide T.S. is added and the mixture allowed to stand well-stoppered, in a warm place, for half an hour.

Sodium Chloride, Sodium Carbonate, Silica.—Dissolve about 10 Gm. of Soap, accurately weighed, in 100 mils of alcohol, with the aid of heat. Transfer the undissolved residue, if any, to a tared filter which has been dried at 100° C. (212° F.) and wash it thoroughly with boiling alcohol. Its weight, after drying at 100° C. (212° F.) does not exceed 1 per cent. of the weight of dry Soap in the original weight taken.

Silica and Other Accidental Impurities.—The weight of this residue, thoroughly washed with distilled water and dried at 100° C. (212° F.) does not exceed 0.15 per cent. of the weight of dry Soap in the original weight taken.

Sodium Hydroxide.—The alcoholic filtrate and washings from the preceding test are not reddened by 3 drops of phenolphthalein T.S.

Dissolve about 10 Gm. of Soap in 200 mils of hot distilled water, add 2 drops of methyl orange T.S. and then diluted sulphuric acid with constant stirring until the aqueous layer becomes red. Boil the mixture until the supernatant layer of the fatty acids is clear and free from solid particles. Separate the aqueous layer with the aid of a siphon and wash the fatty acids by decantation with hot distilled water, until 10 mils of the washings, acidulated with a drop of hydrochloric acid, no longer gives a precipitate on the addition of barium chloride T.S. Now place the dish containing the fatty acids on a water bath and heat until the fatty acids are completely liquefied, then filter the warm acids through a dry filter in a hot-water funnel into a flat dish and dry the acids over sulphuric acid. The iodine number of the acids thus obtained is not less than 84 nor more than 90 (see U. S. P., Test No. 8, Chapter LXII).

U. S. P. Preparations.—Extractum Colocynthidis Compositum; Linimentum Chloroformi (from Soap Liniment); Linimentum Saponis; Pilulæ Aloes; Pilulæ Asafœtidæ.

N. F. Preparations.—Emplastrum Saponis; Pilulæ ad Prandium (Hall's); Pilulæ Aloes et Asafœtidæ; Pilulæ Rhei.

Uses.—Soap is a laxative and antacid; it is used in pill masses, in combination with resins, to render them soluble and to modify their harsh action. It is also used in liniments, plasters, cerates, etc.

SAPO MOLLIS. U. S. Soft Soap

[Sapo Moll.]

	Metric	Old form
***Cottonseed Oil**	430 Gm.	13 oz. av. 332 gr.
Potassium Hydroxide	86 Gm.	2 oz. av. 329 gr.
Alcohol	50 mils	1½ fl. oz.
Water, a sufficient quantity,		
To make	1000 Gm.	32 oz. av.

Dissolve 86 Gm. [old form 2 oz. av. 329 gr.] of potassium hydroxide in 100 mils [old form 3 fl. oz.] of water in a tared, capacious dish with the aid of heat. Immediately add 430 Gm. [old form 13 oz. av. 332 gr.] of cottonseed oil to the hot solution and stir the mixture actively for a few moments. Then reapply the heat and, at the first evidence of froth from boiling, pour in the 50 mils [old form 1½ fl. oz.] of alcohol, stir it actively until the froth suddenly rises, then withdraw the heat and again stir until the Soap assumes the consistence of a paste. Now determine by the method given below whether the product will contain the required excess of potassium hydroxide when water is added to make 1000 Gm. [old form 32 oz. av.]. If the product does not meet the requirements of this test, add more potassium hydroxide or cottonseed oil as may be needed and again heat it until the saponification is complete. Finally add enough water to make the finished product weigh 1000 Gm. [old form 32 oz. av.] and warm it gently, stirring carefully, until the water is all absorbed and a clear soap results.

The potassium hydroxide used in this process should be of the full strength directed by the Pharmacopœia (85 per cent.). Potassium hydroxide of any other strength, however, may be used, if a proportionally larger or smaller quantity is taken, the proper amount for the above formula being ascertained by dividing 7310 by the percentage of KOH contained therein.

This is a soft soap, which is often imported from Germany; it is made from various oils which contain but little stearin. The U. S. P. IX has replaced linseed oil with cottonseed oil largely because of the difficulty in securing a pure linseed oil. The new soap is light yellow in color and the usual synonym "Green Soap" cannot, therefore, be properly applied. It has been demonstrated, however, that the green color adds nothing to the therapeutic value and cottonseed oil soap has long been used with satisfaction. On a large scale the soap may be prepared without the addition of alcohol, heat and concentrated alkali producing saponification. "Green olive oil" has been used to make a green soap. It should contain a little free alkali, but an excess must be avoided; this is regulated by the U. S. P. test.

Official Description.—A soft, unctuous, yellowish-white to brownish-yellow mass.
Odor and Taste.—A slight, characteristic odor and an alkaline taste.
Tests for Identity and Purity.—An aqueous solution of Soft Soap is alkaline to litmus and phenolphthalein T.S.; a solution in hot distilled water (1 in 20) is nearly clear.

Dissolve about 5 Gm. of Soft Soap, accurately weighed, in 100 mils of hot alcohol, collect the residue, if any, on a filter, thoroughly wash it with hot alcohol, and dry it to a constant weight at 100° C. (212° F.). The weight of the residue does not exceed 3 per cent. of the weight of Soap taken. The combined filtrate and washings, on the addition of 0.5 mil of phenolphthalein T.S. and titration with tenth-normal sulphuric acid V.S. shows not less than 0.1 per cent. nor more than 0.25 per cent. of KOH. Each mil of tenth-normal sulphuric acid V.S. used corresponds to 0.00561 Gm. of KOH.

Soft Soap loses not more than 52 per cent. in weight, when tested for water as directed under *Sapo*.

U. S. P. Preparation.—Linimentum Saponis Mollis.
N. F. Preparations.—Linimentum Saponis Mollis Compositum; Pasta Betanaphtholis; Unguentum Sulphuris Compositum.

Uses.—Green soap is used in skin diseases, chiefly in eczema, and largely as a detergent in surgery.

Unsaponifiable Fats and Petroleum Products

Under this head will be found several official products which cannot be classed properly with either the fixed or the volatile oils, yet which in some respects partake of the properties of both. Petrolatum in its several forms, paraffin, and petroleum benzin are products from petroleum, and are hydrocarbons belonging to the methane series.

PETROLATUM LIQUIDUM. U. S. Liquid Petrolatum

[Petrolat. Liq.—LIQUID PARAFFIN MINERAL OIL]

A mixture of liquid hydrocarbons obtained from petroleum. Preserve it in well-closed containers, protected from light.

Preparation.—After removing the lighter hydrocarbons from petroleum, by distillation, the residue is again subjected to distillation at a temperature between 330° and 390° C. (626° and 734° F.) and the distillate treated, first with sulphuric acid, then with sodium hydroxide, and afterwards decolorized, by filtering through bone black, animal charcoal, or Fuller's earth. The purified product is again chilled, to remove paraffin, and redistilled at a temperature above 330° C. (626° F.). In some instances the sulphuric acid treatment is omitted.

Official Description.—*Heavy Liquid Petrolatum.*—Heavy Liquid Petrolatum has a viscosity of *not less* than 3.1 when determined by the test given below.

Official Description.—*Light Liquid Petrolatum.*—Light Liquid Petrolatum has a viscosity of *not more* than 3 when determined by the test given below and vaporizes freely.

Each variety conforms to the following description and tests:

Specific Gravity.—0.828 to 0.905 at 25° C. (77° F.).

Official Description.—A colorless, transparent, oily liquid, free, or nearly free, from fluorescence, odorless and tasteless when cold, and possessing not more than a faint petroleum odor when heated.

Tests for Identity.—*Solid Paraffins.*—When cooled to 10° C. (50° F.), Liquid Petrolatum does not become more than opalescent.

Insoluble in water or alcohol; soluble in ether, chloroform, petroleum benzin, or in fixed or volatile oils. Camphor, menthol, thymol, and many similar substances are dissolved by Liquid Petrolatum.

Impurities and Tests for Impurities.—*Acids.*—Boil 10 mils of Liquid Petrolatum with an equal volume of alcohol; the alcoholic liquid is not acid to litmus.

Carbonizable Impurities.—Introduce into a glass-stoppered cylinder, which has been previously rinsed with sulphuric acid, 5 mils of Liquid Petrolatum and 5 mils of colorless sulphuric acid, heat in a water bath during ten minutes, shaking well at intervals of thirty seconds; the oil remains unchanged in color and the acid does not become darker than pale amber.

Sulphur Compounds.—Prepare a clear, colorless saturated solution of lead oxide in an aqueous solution of sodium hydroxide (1 in 5), and mix 2 drops of this solution with 4 mils of Liquid Petrolatum and 2 mils of dehydrated alcohol; the mixture does not darken after heating for ten minutes at 70° C. (158° F.) and cooling.

Viscosity.—Make a permanent mark about 2 cm. below the bulb of a 50 mil pipette of the usual type and note the time, in seconds, required at 25° C. (77° F.) for the level of distilled water to fall from the upper to the lower mark as the liquid flows from the pipette. The time should not be less than twenty-five seconds nor more than thirty seconds for the pipette selected.

Draw the Liquid Petrolatum to be tested into this pipette, which should be clean and dry, and note the time, in seconds, required at 25° C. (77° F.) for its level to fall from the same upper to the lower mark as used for the water. Divide the number of seconds thus noted by the number of seconds required for water to fall from the upper to the lower mark, as above determined. The quotient indicates the viscosity. Distilled water at 25° C. (77° F.) is taken as 1.

N. F. Preparations.—Nebula Aromatica; Nebula Eucalyptolis; Nebula Mentholis; Nebula Mentholis Composita; Nebula Thymolis; Pasta Resorcinolis Fortior; Pasta Resorcinolis Mitis; Petroxolins.

Uses.—Liquid Petrolatum is used as a basis for medicinal unctuous preparations, for spraying the nasal passages, and as a laxative, its efficiency being due to mechanical lubrication. For this purpose an oil of high viscosity, the so-called "heavy oil" is usually preferred as the lighter oils have a tendency to produce leakage. The lighter oils are used for spraying. Because of the large use of this oil as a laxative, it has been sold under many special names. (See U. S. Dispensatory, 20th Edition).

PETROLATUM. U. S. Petrolatum
[**Petrolat.**—PETROLATUM OINTMENT PETROLEUM JELLY]

A purified mixture of semi-solid hydrocarbons, obtained from petroleum.

Preparation.—The "residuums," as they are termed technically, which are obtained by the distillation of petroleum, are purified by melting, usually treating with sulphuric acid, and then percolating them through recently burned bone black; this abstracts the odor and the color. The consistency is varied by mixing them with certain portions of the harder paraffins and stirring them until a homogeneous mixture is made.

Official Description.—An unctuous mass, varying in color from yellowish to light amber, having not more than a slight fluorescence, even after being melted; it is transparent in thin layers; completely amorphous.

Odor and Taste.—Free or nearly free from odor or taste.

Solubility.—Insoluble in water; almost insoluble in cold or hot alcohol, or in cold dehydrated alcohol; freely soluble in ether, chloroform, carbon disulphide, oil of turpentine, petroleum benzin, benzene, or in most fixed or volatile oils.

Specific Gravity.—0.820 to 0.865 at 60° C. (140° F.).

Tests for Identity.—It melts between 38° and 54° C. (100.4° and 129.2° F.).

Impurities and Tests for Impurities.—Heat about 2 Gm. of Petrolatum in an open porcelain or platinum dish, over a Bunsen flame; it volatilizes without emitting an acrid odor, and on incineration not more than 0.05 per cent. of ash remains.

Acids or Alkalies.—Shake melted Petrolatum with an equal volume of hot distilled water; the latter remains neutral to litmus.

Fixed Oils, Fats, or Rosin.—Digest 10 Gm. of Petrolatum at 100° C. (212° F.) for half an hour with 10 Gm. of sodium hydroxide and 50 mils of distilled water, then separate the aqueous layer and supersaturate it with sulphuric acid; no oily or solid substance separates.

U. S. P. Preparations.—Unguentum Hydrargyri Dilutum; Unguentum Hydrargyri Oxidi Flavi.

N. F. Preparations.—Emulsum Petrolati; Pasta Betanaphtholis; Pasta Zinci; Unguentum Hydrargyri Oxidi Rubri; Unguentum Resorcinolis Compositum.

Uses.—Petrolatum is used as a basis for ointments, for which it is well adapted. It is, however, not so readily absorbed as are other unctuous bases. It, with liquid petrolatum and crude petrolatum, is used also internally in the treatment of lung diseases, administered in the form of emulsions, capsules and in pills, mixed with solid ingredients. It is known commercially as *cosmoline, vaseline, petrolina, deodorolina, albolene,* etc.

PETROLATUM ALBUM. U. S. White Petrolatum
[**Petrolat. Alb.**—WHITE PETROLEUM JELLY]

Petrolatum wholly or nearly decolorized.

Preparation.—It is prepared in the same manner as Petrolatum, the process being carried further until the product is practically free from yellow color. The product often sold for white petrolatum, made by mixing paraffin and liquid petrolatum, is not satisfactory for pharmaceutical purposes as it is granular and the liquid portion often separates. The U. S. P. test excludes this variety.

Official Description.—A white or faintly yellowish unctuous mass, transparent in thin layers even after cooling to 0° C. (32° F.); completely amorphous.

Tests for Identity and Purity.—In other respects White Petrolatum has the characteristics of and responds to the tests for identity and purity under *Petrolatum.*

U. S. P. Preparations.—Unguentum Acidi Borici; Unguentum Diachylon; Unguentum Hydrargyri Ammoniati.

N. F. Preparations.—Ceratum Camphoræ; Ceratum Plumbi Subacetatis; Unguentum Zinci Stearatis.

Uses.—White petrolatum is a basis for ointments and cerates.

PARAFFINUM. U. S. **Paraffin**
[Paraff.]

A purified mixture of solid hydrocarbons, usually obtained from petroleum.

Hard *paraffin,* or paraffin wax, is a solid, white, diaphanous substance resembling white wax, which is made by distilling the residuum obtained from the refining of petroleum and collecting and purifying the distillate. It can be mixed in all proportions with wax, stearin, palmitin, and rosin, but it is difficult to prevent the mixtures from "granulating," even after prolonged stirring.

Official Description.—A colorless, or white, more or less translucent mass, crystalline when separating from solution.

Odor and Taste.—Without odor or taste, and slightly greasy to the touch.

Solubility.—Insoluble in water or alcohol; slightly soluble in dehydrated alcohol, freely soluble in ether, petroleum benzin, benzene, carbon disulphide, volatile oils, or in most warm fixed oils.

Specific Gravity.—About 0.900 at 25° C. (77° F.).

Tests for Identity and Purity.—It melts between 50° and 57° C. (122° and 134.6° F.). When strongly heated, it ignites, burns with a luminous flame, and deposits carbon.

Heat about 0.5 Gm. of Paraffin in a dry test tube with an equal weight of sulphur; the mixture becomes black from separated carbon, and hydrogen sulphide gas is evolved.

Paraffin is not acted upon or colored by concentrated sulphuric acid or nitric acid in the cold.

Acids.—Shake melted Paraffin with an equal volume of hot alcohol; the separated alcohol does not redden moistened blue litmus paper.

U. S. P. Preparation.—Unguentum Acidi Borici.

Uses.—It is used in making ointments.

BENZINUM PURIFICATUM. U. S. **Purified Petroleum Benzin**
[Benzin. Purif.—Petroleum Ether]

A purified distillate from American petroleum consisting of hydrocarbons, chiefly of the marsh-gas series. Preserve it carefully in well-closed containers, in a cool place, remote from fire. The U. S. P. VIII method of purification was as follows:

	Metric	Old form
Potassium Permanganate	10 Gm.	146 grains
Sodium Hydroxide	2 Gm.	29 grains
Sulphuric Acid	60 mils	2 fl. oz.
Petroleum Benzin	1000 mils	2 pints
Water, a sufficient quantity.		

Add the acid to 550 mils [old form 17½ fl. oz.] of water, and when the mixture has become cold, pour it into a bottle having the capacity of about two liters [old form 4 pints]. Add 8 Gm. [old form 117 grains] of potassium permanganate and agitate until it is dissolved, then add the petroleum benzin, in four portions, shaking the liquid after each addition. Allow the liquids to remain in contact for 24 hours, shaking the bottle at frequent intervals; then decant the petroleum benzin into another bottle of the same capacity, and having dissolved 2 Gm. [old form 29 grains] of potassium permanganate in 240 mils [old form 8 fl. oz.] of water, in which the sodium hydroxide has previously been dissolved, mix the liquids and agitate the mixture frequently during several hours, then decant, repeat the washing with water, and again decant the purified petroleum benzin.

Official Description.—A clear, colorless, non-fluorescent, volatile liquid, of an ethereal or faint, petroleum-like odor, and having a neutral reaction. It is highly inflammable and its vapor, when mixed with air and ignited, explodes violently.

Solubility.—Insoluble in water; freely soluble in alcohol, and miscible with ether, chloroform, benzene, volatile oils, and fixed oils, with the exception of castor oil.

Specific Gravity.—0.638 to 0.660 at 25° C. (77° F.).

Tests for Identity and Purity.—It distils completely between 40° and 80° C. (104° and 176° F.).

Evaporate 10 mils of Purified Petroleum Benzin from a piece of clean filter paper; no greasy stain remains, and the odor is not disagreeable nor notably sulphuretted. Not more than 0.0015 Gm. of residue remains on evaporating 50 mils of Purified Petroleum Benzin at a temperature not exceeding 40 ° C. (104° F.).

Pyrogenous Products and Sulphur Compounds.—Boil 10 mils of Purified Petroleum Benzin for a few minutes with one-fourth its volume of an alcoholic solution of ammonia (1 in 10) and a few drops of silver nitrate T. S.; the liquid does not turn brown.

Benzene.—Add 5 drops of Purified Petroleum Benzin to a mixture of 40 drops of sulphuric acid and 10 drops of nitric acid in a test tube, warm the liquid for about ten minutes, set it aside for half an hour, and dilute it in a shallow dish with water; no odor of nitrobenzene is evolved.

U. S. P. Preparations.—Extractum Aconiti; Extractum Colchici Cormi; Extractum Ergotæ; Extractum Nucis Vomicæ; Extractum Physostigmatis; Fluidextractum Colchici Seminis; Tinctura Lactucarii; Tinctura Strophanthi; Tinctura Opii Deodorati.

Uses.—Petroleum benzin is a useful solvent for fats, resins, oils, caoutchouc, and similar bodies. It is not identical with benzene, the product obtained in the destructive distillation of coal. The object of introducing purified petroleum benzin into the Pharmacopœia was to furnish a solvent which would not communicate a disagreeable odor to preparations, as is the case when commercial petroleum benzin is used.

QUESTIONS ON FIXED OILS, FATS, AND SOAPS

Fixed oils and fats—(See page 1235.) Whence are they obtained?
What are their general properties; solubilities, color, odor, taste, consistence, etc.?
What is their specific gravity?
What change takes place upon exposure to air?
How may oils which have become rancid often be purified?
What are fixed oils and fats, chemically?
In most cases, of what do they consist?
What are these proximate principles sometimes termed?
To what is the consistence of fixed oils and fats due?
Why is almond oil liquid and tallow solid at ordinary temperatures?
Chemically considered, what is olein? What is its formula in symbols?
How may it be obtained?
What are the physical properties of olein?
What is meant by hydrogenation of oils? What is the value of this process?
How does palmitic acid occur?
Chemically, what is palmitin?
Stearin—Where is it found and how is it made?

How may it be obtained pure? Describe odor, taste, and chemical reaction.
What is its melting point?
Of what does it consist, and how has it been formed synthetically?
Margarin—What has the substance long known under this name been shown to be?
How has margaric acid been obtained?
Stearic acid—What is the formula in symbols?
Give description, melting point, and solubility. For what is it used?
Palmitic acid—What is the formula in symbols?
What is its form? Its melting point?
Oleic acid—What is the formula in symbols?
Give description, solubility, odor, and taste.
At what temperature does it crystallize?
Sweet almond—What is the Latin name? How should it be preserved? What does it contain?
Why does the fixed oil form an emulsion by simple trituration of the almond with water? What is its official preparation? Give its uses.
Expressed oil of almond—What is the Latin name? Give the synonym.
Where and how is this oil obtained?
How much oil does sweet almond yield?
How much oil does bitter almond yield?
How may a colorless oil be obtained?
What is its specific gravity? Describe appearance, odor, taste, solubility, and tests for identity. Of what does it principally consist?
At what temperature does it congeal?
How may it be distinguished from most other fixed oils?
What is its saponification value?
What is its iodine value? How is this figure obtained?
Into what official preparations does it enter?
For what is it used?
Olive oil—What is its source?
Is commercial olive oil usually pure?
What is its specific gravity?
Describe appearance, odor, taste, solubility, and tests for identity.
How may the following impurities be detected?—viz.: Cottonseed oil; sesame oil. Give its saponification value and iodine value.
What are its uses? What are its official preparations?
Cottonseed oil—What is its source and how is it made?
How much oil does cottonseed contain? What is its specific gravity?
Describe appearance, odor, taste, solubility, and tests for identity.
At what temperature does it begin to congeal?
Give its saponification value and iodine value.
For what is it used?
Linseed oil—What is the Latin name? What are its synonyms?
How is it prepared?
Of what does it consist? Why is "boiled oil" unfit for medicinal use?
To what does it owe its drying property? What is its specific gravity?
Describe appearance, odor, taste, chemical reaction, and solubility.
At how low a temperature does it remain liquid?
How may the following impurities be detected? Non-drying oils; free acid; mineral oils and rosin oils; rosin or rosin oils. Give its saponification value and iodine value.
What are its uses and the dose?
Pepo—What is the Latin official name? Give the synonym. What is its source and the official description?
What are its constituents?
For what is it used and in what form?
How is the fixed oil obtained?
Castor oil—What is its source?
In what four ways has castor oil been obtained?
Which method produces the best oil?
What principles does castor oil contain?
To what is the purgative action due? How is this shown? What is the saponification value and the iodine value?
What is its specific gravity?

Describe appearance, odor, taste, solubility, tests for identity, and tests for the absence of foreign oils.
What is the dose?
Sesame oil—What are its synonyms?
Give its definition and description.
How may foreign oils be detected?
In what official preparations is it used?
What advantage does this oil possess as compared with cottonseed oil?
Croton oil—What is its Latin official name? What is its source? Whence is it derived? How is it prepared? What are the constituents? What is the specific gravity?
Describe appearance, odor, taste, chemical reaction, solubility, tests for identity and purity.
What is its saponification value and iodine value?
What effect does it produce when applied to the skin?
Have the active principles been isolated?
What acids have been detected as having been formed by the decomposition of the fatty substances present?
Name its official preparations. What are its uses and the dose?
Oil of theobroma—What is the Latin name? What are its synonyms?
What is its source? How is it prepared? What is the yield of oil?
Describe appearance, odor, taste, and chemical reaction. What are its melting point, solubility, and specific gravity?
Give the test for identity. How may the following impurities be detected? Wax stearin, tallow, etc. Give the saponification value and iodine value.
What are its chemical constituents?
For what is it used?
Cocoa—What is its Latin title? Give the synonym. What is its source and how prepared? Describe its appearance, odor, and taste.
What are the official preparations?
What are its uses?
Lycopodium—What is lycopodium? Give the official description.
What does it contain? What are its uses?
Oleic acid—What is the Latin name?
Give the formula in symbols.
How is it obtained?
What is "red oil"? What is its specific gravity?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected? Mineral acids, undecomposed fat or mineral oil.
What are its official preparations?
How is it used and upon what does its value depend?
Stearic acid—Give the Latin title and chemical formula in symbols. How is it obtained?
Give the description, odor, taste, solubility, and tests for identity and purity. For what is it used officially? What is its chief pharmaceutical use?
Glycerin—By what other name is it known? What is its percentage of absolute glycerin.
What is the chemical composition of absolute glycerin?
How is glycerin obtained?
Explain the reaction which takes place in making lead plaster.
What is Tilghman's process for making it?
Explain the reaction which takes place in making glycerin by this process from stearin.
Chemically, to what class does glycerin belong, and what is it sometimes called?
What is its atomicity?
Describe appearance, odor, taste, chemical reaction, and solubility. What is the specific gravity? Give tests for identity.
How may the following impurities be detected? Readily carbonizable impurities; fatty acids and esters; oxalic acid; sulphate; heavy metals; arsenic; acrolien; glucose; ammonium compound.
What are its uses?

Spirit of glyceryl trinitrate—What is the Latin official title? By what other English title is it known? How is it made? For what is it used? What are its synonyms?
What is the percentage strength of the official solution?
Soap—What is the Latin name? What is its synonym?
What is its definition?
How is it made? What is grain soap?
How may soap shavings be used to advantage in pharmacy?
How may it be purified?
How is toilet soap made?
What is the difference between hard soaps and soft soaps?
What change takes place when fats and oils undergo saponification?
What is the difference between soluble and insoluble soaps?
What are the two official soluble soaps?
What insoluble soaps are employed in pharmacy?
Describe the appearance, odor, taste, chemical reaction, and solubility of castile soap.
How may the following impurities be detected? An undue amount of water; animal fat; metallic impurities; sodium chloride; sodium carbonate; silica and other accidental impurities; limit of alkalinity.
What are its medicinal properties?
What are its uses? What are its official preparations?
Soft soap—What is the Latin official name?
How is it made officially? Why is the amount of free alkali so carefully regulated?
How may it be prepared on a large scale?
Describe the test for a limit of free alkali. How much water should it contain?
How may soft soap, green in color, be made?
Describe its appearance, odor, taste, chemical reaction, and solubility.
For what is it used? What are its official preparations?
Liquid petrolatum—Give the Latin official title. Give the synonyms.
What is it chemically and how obtained?
Give description, odor, taste, specific gravity, solubility, and test for identity.
How may acid impurities be detected? How detect the presence of carbonizable impurities and sulphur compounds?
How may its viscosity be determined? How is it used medicinally and pharmaceutically and in what official preparations?
Petrolatum—What is petrolatum? What are the synonyms?
How is it prepared?
Give description, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected? Acids; alkalies; fixed oils; fats; rosin.
Name the official preparations. What is its use? By what name is it known commercially?
White petrolatum—What is the Latin title? Give the synonym.
How is it prepared? What similar product is unsatisfactory and why?
Give the official description. In what official preparations is it used?
What is paraffin? How is it obtained? What is its specific gravity?
Describe appearance, odor, taste, chemical reaction, and solubility. Give the tests for identity.
Can it be mixed readily with wax, resin, stearin, etc.?
Does it make a smooth mixture?
Petroleum benzin—Give the Latin name, and synonym. What is petroleum benzin?
What is its specific gravity?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
Give the test for and the difference from and absence of benzin.
For what is it used?
Is it identical with benzene?
Purified petroleum benzin—Describe a process by which this substance may be purified. Give odor, test for identity, and tests for the following impurities: Pyrogenous products and sulphur compounds, benzene.
For what is it used?

CHAPTER LIX

DRUGS CONTAINING GLUCOSIDES OR NEUTRAL PRINCIPLES, WITH THEIR PREPARATIONS

GLUCOSIDES are bodies mostly found in plants, yielding glucose, $C_6H_{12}O_6$, as one of their products of decomposition when brought in contact with diluted acids or ferments. The other product which is formed at the same time differs in character from the original glucoside. Thus, *salicin,* if boiled with diluted sulphuric acid, yields dextro-glucose and *saligenin,* or *saligenol.*

$$\underset{\text{Salicin}}{C_{13}H_{18}O_7} + \underset{\text{Water}}{H_2O} = \underset{\text{Saligenin}}{C_7H_8O_2} + \underset{\text{Glucose}}{C_6H_{12}O_6}$$

Glucosides may sometimes be split into glucose and the derived product by heating them with baryta water or alkaline solutions, by nitrogenous principles, which act as ferments, like *emulsin* or *synaptase,* or by treatment with yeast ferment or *ptyalin* found in saliva.

Glucosides are sometimes the active principles of the plants in which they are found, but they are more frequently associated with resins, oils, alkaloids, and bitter principles, and for this reason they have not been used to form a separate group for classification in this work. Frequent mention, however, will be made of them when the occasion arises, in connection with the drug containing them, and the official drugs containing neutral principles have been classed with them.

The following list gives a view of some of the glucosides, with their derivatives:

Glucosides

Glucoside	Source	Derivatives
Adonidin	From *Adonis vernalis*	
Æsculin, $C_{15}H_{16}O_9$	From *Æsculus Hippocastanum*	Æsculetin
Amygdalin, $C_{20}NH_{27}O_{11}$	From *Prunus amygdalus*	Oil of bitter almond and hydrocyanic acid
Arbutin, $C_{12}H_{16}O_7$	From *Uva Ursi* and other Ericaceæ	Hydroquinone and methylhydroquinone
Bryonin, $C_{34}H_{48}O_9$	From *Bryonia alba* and *B. dioica*	Bryoretin and bryogenin
Colocynthin, $C_{56}H_{84}O_{23}$	From *Citrullus colocynthis*	Colocynthein
Convallamarin, $C_{23}H_{44}O_{12}$	From *Convallaria majalis*	Convallamaretin
Convallarin, $C_{34}H_{62}O_{11}$	From *Convallaria majalis*	Convallaretin
Convolvulin, $C_{31}H_{50}O_{16}$	From *Exogonium Purga*	Convolvulinic acid and methyl-ethyl acetic acid
Crocin, $C_{44}H_{70}O_{28}$	From *Crocus sativus*	Crocetin
Daphnin, $C_{15}H_{16}O_9$	From *Daphne Mezereum*	Daphnetin
Datiscin, $C_{21}H_{22}O_{12}$	From *Datisca cannabina*	Datiscetin
Digitalin, $C_{35}H_{56}O_{14}$	From *Digitalis purpurea*	Digitaligenin and digitalose
Elaterin, $C_{20}H_{28}O_5$	From *Elaterium*	
Fraxin, $C_{32}H_{36}O_{20}$	From *Fraxinus Ornus*	Fraxetin
Gentiopicrin, $C_{20}H_{30}O_{12}$	From *Gentiana lutea*	Gentiogenin
Globularin, $C_{20}H_{44}O_{14}$	From *Globularia Alypum*	Globularetin
Glycyrrhizin, $C_{44}H_{63}NO_{18}$	From *Glycyrrhiza glabra*	Glycyrrhetin
Gratiolin, $C_{20}H_{34}O_7$	From *Gratiola officinalis*	Gratioletin and gratiolaretin
Gratiosolin, $C_{46}H_{84}O_{25}$	From *Gratiola officinalis*	Gratiosoletin
Helicin, $C_{13}H_{16}O_7$	From Salicin	Salicyl aldehyde

Glucosides—*Continued*

Glucoside	Source	Derivatives
Jalapin, $C_{68}H_{112}O_{32}$	From *Exogonium purga*	Jalapinol
Ononin, $C_{30}H_{34}O_{13}$	From *Ononis spinosa*	Formonetin
Phillyrin, $C_{27}H_{34}O_{11}$	From *Phillyria latifolia*	Phillygenin
Phlorizin, $C_{21}H_{24}O_{10}$	From the bark of the pear, apple, cherry, and plum tree	Phloretin
Pinipicrin, $C_{22}H_{36}O_{11}$	From *Thuja occidentalis*	Ericinol
Populin, $C_{20}H_{22}O_8$	From different species of Populus	Benzoic acid, saliretin
Prophetin, $C_{23}H_{36}O_7$	From *Cucumis prophetarum*	Propheretin
Quercitrin, $C_{36}H_{38}O_{30}$	From *Quercus tinctoria*	Quercetin
Quinovin, $C_{38}H_{62}O_{11}$	From the bark of Cinchonas	Quinovic acid
Salicin, $C_{13}H_{18}O_7$	From different species of Salix and Populus	Saligenin
Santonin, $C_{15}H_{18}O_3$	From *Artemisia pauciflora*	Santoniretin
Saponin, $C_{32}H_{54}O_{18}$	From *Saponaria officinalis*	Saponetin
Thujin, $C_{20}H_{22}O_{12}$	From *Thuja occidentalis*	Thujigenin and thujetin
Xanthorhamnin, $C_{48}H_{66}O_{29}$	From *Rhamnus amygdalinus*	Rhamnetin

GENTIANA. U. S. Gentian

[**Gentian.**—Yellow Gentian Root]

The dried rhizome and roots of *Gentiana lutea* Linné (Fam. *Gentianaceæ*).

Official Description.—In nearly cylindrical, sometimes branching pieces, of variable length, from 5 to 35 mm. in thickness; externally yellowish-brown, the rhizome portion annulate, the roots longitudinally wrinkled; fracture short and uneven when dry, but tough and flexible when damp; internally yellowish-brown, the bark from 0.5 to 2 mm. in thickness, separated from the somewhat spongy woody portion by a dark brown cambium zone.

Odor and Taste.—Odor strong, characteristic; taste slightly sweetish, then strongly and persistently bitter.

Tests for Identity and Purity.—The powder is light brown or yellowish-brown, consisting chiefly of parenchymatous cells with fragments of scalariform or reticulate tracheæ; starch grains few or none. Stone cells and sclerenchymatous fibers are absent.

Gentian yields not more than 6 per cent. of ash.

U. S. P. Preparations.—Extractum Gentianæ; Fluidextractum Gentianæ; Tinctura Gentianæ Composita.

N. F. Preparations.—Elixir Gentianæ (from Fluidextract); Elixir Gentianæ et Ferri (from Fluidextract); Elixir Gentianæ et Ferri Phosphatis (from Fluidextract); Elixir Gentianæ Glycerinatum (from Fluidextract); Infusum Gentianæ Compositum; Pilulæ Antiperiodicæ (from Extract); Pilulæ Ferri, Quininæ, Aloes et Nucis Vomicæ (from Extract); Pilulæ Antiperiodicæ sine Aloe (from Extract); Tinctura Amara; Tinctura Antiperiodica; Tinctura Antiperiodica sine Aloe; Tinctura Rhei et Gentianæ; Tinctura Zedoariæ Amara; Vinum Aurantii Compositum.

Gentian contains the glucoside *gentiopicrin*, $C_{20}H_{30}O_{12}$ (which splits, when heated with dilute acids, into gentiogenin and glucose), *gentisic acid*, $C_{14}H_{10}O_5$, pectin, sugar (*gentianose*), and a little fixed oil. A dark green coloration is produced when a ferric salt is added to a preparation of gentian; this is said to be due to the reaction with gentisic acid. If the preparation is treated with ferric hydroxide, and then filtered, or if mixed with an alkaline citrate, the tendency to become discolored is lost.

Uses.—Gentian is a bitter tonic. Dose, fifteen grains (1 Gm.).

CALUMBA. U. S. Calumba

[Calumb.—COLUMBA COLUMBO COLOMBO]

The dried root of *Jateorhiza palmata* (Lamarck) Miers (Fam. *Menispermaceæ*).

Official Description.—In circular or oval disks attaining a diameter of 9 cm. and seldom exceeding 2 mm. in thickness, or in longitudinal or in oblique slices attaining a length of 30 cm., a breadth of 35 mm. and a thickness of 16 mm.; externally brown and roughly wrinkled; cut surface varying from yellowish-brown to grayish-yellow, the transverse slices distinctly radiate in the outer portion and with a dark cambium; central portion often depressed; fracture short, mealy.

Odor and Taste.—Odor slight; taste slightly aromatic, very bitter.

Tests for Identity and Purity.—The powder is greenish-brown to grayish-yellow; starch grains numerous, mostly single, occasionally 2- to 3-compound, the individual grains from 0.003 to 0.085 mm. in the long diameter, ovoid, ellipsoidal, frequently very irregular, slightly lamellated, with an excentral linear x-shaped or branching cleft; stone cells few with irregularly thickened, strongly lignified, coarsely porous walls and containing one or more prisms of calcium oxalate from 0.01 to 0.03 mm. in length, or numerous sphenoidal micro-crystals; fragments with tracheæ few, the latter with reticulate thickenings or bordered pores, and associated with wood-fibers having long, oblique, slit-like pores.

Calumba yields not more than 8 per cent. of ash.

U. S. P. Preparation.—Tinctura Calumbæ.
N. F. Preparation.—Fluidextractum Calumbæ.

This African root owes its virtues to *columbin,* $C_{21}H_{22}O_7$, and *berberine,* both of which are very bitter; starch and colombic acid are present, with a mucilage which is often troublesome by interfering with percolating operations. Calumba must not be in very fine powder if it is to be percolated with diluted alcohol.

Uses.—It is a bitter tonic. Dose, thirty grains (2 Gm.).

QUASSIA. U. S. Quassia

[Quass.—BITTER WOOD]

The wood of *Picrasma excelsa* (Swartz) Planchon, known in commerce as Jamaica Quassia, or of *Quassia amara* Linné, known in commerce as Surinam Quassia (Fam. *Simarubaceæ*).

Jamaica Quassia.—Official Description.—Usually in chips, raspings or shavings, occasionally in small cubes or billets; yellowish-white or bright yellow, with a few light gray pieces somewhat coarsely grained; fracture tough, fibrous.

Odor and Taste.—Odor slight; taste bitter.

Under the microscope, sections of Jamaica Quassia show large tracheæ either single or in groups of 2 to 5, the walls being marked by numerous small, bordered pores, and the contents being often of a yellowish color; medullary rays mostly 1 to 5 cells wide and from 10 to 20 rows deep; calcium oxalate, in crystal fibers near the medullary rays, in 4- to 6-sided prisms, from 0.006 to 0.03 mm. in length; wood-fibers with thin walls and oblique pores; starch grains few, spherical or ellipsoidal, from 0.01 to 0.015 mm. in diameter.

Surinam Quassia.—Official Description.—The crude drug and microscopic sections closely resemble the Jamaica variety; tracheæ usually single or in pairs, sometimes in groups of 3 or 4; medullary rays in narrower and larger groups than in the Jamaica variety, from 1 to 4 cells wide and from 10 to 30 rows deep; calcium oxalate crystals few or entirely absent, thus distinguishing the variety from Jamaica Quassia.

U. S. P. Preparation.—Tinctura Quassiæ.
N. F. Preparations.—Extractum Quassiæ; Fluidextractum Quassiæ.

Quassia contains *quassin* (*picrasmin*), $C_{32}H_{44}O_{10}$, which is intensely bitter, and soluble in both alcohol and water; there are also present resin, mucilage, etc.

Uses.—It is a bitter tonic. Dose, eight grains (0.5 Gm.).

SALICINUM. U. S. Salicin

[**Salicin.**]

A glucoside [$C_{13}H_{18}O_7 = 286.14$] obtained from several species of *Salix* and *Populus* (Fam. *Salicaceæ*). Preserve it in well-closed containers.

Preparation.—A boiling concentrated decoction of the bark is treated with lead oxide or basic lead acetate until it becomes nearly colorless. Gum, tannin, and extractive matter, which would impede the crystallization of the salicin, are thus removed from the liquid; while a portion of the oxide is dissolved in combination probably with the salicin. To separate this portion of oxide, sulphuric acid is first added, and then barium sulphide, and the liquor is filtered and evaporated. Salicin is deposited, and may be purified by repeated solution and crystallization. It has been produced synthetically from helicin. It may also be prepared by boiling the bark with milk of lime to remove tannin, evaporating the filtrate to a soft extract, digesting this with alcohol, distilling off the alcohol, and obtaining the salicin in crystals from the residue. Salicin is a glucoside, splitting into saligenin and sugar under the influence of dilute acids and heat.

Official Description.—It occurs in colorless, silky, shining, crystalline needles or rhombic prisms, or as a white, crystalline powder.

Odor, Taste, and Reaction.—Odorless, and having a very bitter taste. Its aqueous solution (1 in 30) is neutral to litmus.

Solubility.—One Gm. of Salicin dissolves in 23.5 mils of water and in 88.5 mils of alcohol at 25° C. (77° F.); also in 3.3 mils of water at 80° C. (176° F.) and in 30 mils of alcohol at 60° C. (140° F.); insoluble in chloroform or ether.

Tests for Identity.—It is lævorotatory. It melts between 198° and 202° C. (388.4° and 395.6° F.).

Heat a small portion of Salicin in a test tube until it turns brown, then add a few mils of distilled water, and afterwards a drop of ferric chloride T.S.; a violet color is produced.

Salicin with sulphuric acid gives a red color, which disappears upon the addition of distilled water.

Heat gently about 0.1 Gm. of Salicin with about 0.2 Gm. of potassium dichromate and 2 mils of diluted sulphuric acid; the fragrant odor of salicylic aldehyde is developed.

Impurities and Tests for Impurities.—Incinerate about 2 Gm. of Salicin; not more than 0.05 per cent. of ash remains.

Salicylic Acid.—Ten mils of an aqueous solution of Salicin (1 in 50) is not colored violet by a few drops of ferric chloride T.S.

Alkaloids.—Separate portions of 10 mils each of an aqueous solution of Salicin (1 in 50) yield no precipitate on the addition of 1 mil of tannic acid T.S., picric acid T.S., or mercuric potassium iodide T.S.

Heavy Metals.—An aqueous solution of Salicin does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Uses.—Salicin is used as a febrifuge, in doses of fifteen to thirty grains (1 to 2 Gm.).

TARAXACUM. U. S. Taraxacum

[**Tarax.**—DANDELION]

The dried rhizome and roots of *Taraxacum officinale* Weber (Fam. *Compositæ*). Preserve the thoroughly dried drug in tightly-closed containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects.

Official Description.—Cylindrical or somewhat flattened, gradually tapering, usually in broken pieces, from 6 to 15 cm. in length and from 5 to 15 mm. in thickness; externally brown or blackish-brown, longitudinally wrinkled, having numerous root and rootlet-scars; crown simple or branched with numerous leaf-bases showing annulate markings.

Odor and Taste.—Odor slight or inodorous; taste bitter.

Tests for Identity and Purity.—Under the microscope, transverse sections of the root of Taraxacum show a porous, pale yellow wood from 1 to 4 mm. in diameter, surrounded by a light brown bark from 2 to 6 mm. in thickness, the latter composed of concentric layers of laticiferous vessels and sieve tissues, alternating with whitish inulin-bearing parenchyma. The rhizome portions show a small pith.

The powder is light brown; when examined under the microscope it exhibits parenchyma cells which are large, thin-walled and contain irregular masses of inulin; fragments with yellowish-brown laticiferous vessels; tracheæ reticulate; intermediate fibers non-lignified, with irregular, simple and oblique pores.

Taraxacum yields not more than 10 per cent. of ash.

U. S. P. Preparations.—Extractum Taraxaci; Fluidextractum Taraxaci.

N. F. Preparations.—Elixir Gentianæ Glycerinatum; Elixir Taraxaci Compositum.

Taraxacum owes its bitterness to *taraxacin,* an acrid crystalline principle, soluble in alcohol and water. It also contains pectin, sugar, resin, gum, etc.

Uses.—It is used as a cholagogue. Dose, two drachms (8 Gm.).

SCILLA. U. S. Squill
[Scill.]

The fleshy, inner scales of the bulb of the white variety of *Urginea maritima* (Linné) Baker (Fam. *Liliaceæ*), cut into pieces and carefully dried. Preserve Squill in tightly-closed containers, in a dry place. If made into the official tincture and assayed biologically, the minimum lethal dose should not be greater than 0.006 mil of tincture, or the equivalent in tincture of 0.0000005 Gm. of ouabain, for each gramme of body weight of frog.

Official Description.—In irregular, more or less curved, somewhat flattened pieces, from 0.5 to 5 cm. in length, yellowish-white, somewhat translucent, nearly smooth and lustrous with slight projections of fibro-vascular bundles; brittle when dry and somewhat flexible when damp.

Odor and Taste.—Odor slight; taste bitter and acrid.

Tests for Identity and Purity.—Under the microscope, sections of the scales of Squill show on the upper and lower surface a thin-walled epidermal layer, a mesophyll of nearly isodiametric or slightly elongated thin-walled cells and occasionally show in alcoholic or glycerin mounts spheroidal aggregates of a carbohydrate; numerous more or less rectangular cells containing mucilage and bundles of raphides of calcium oxalate, the latter from 0.075 to 1.0 mm. in length; fibro-vascular bundles few and isolated, with spiral or reticulate tracheæ. Occasionally some of the parenchyma cells contain a few somewhat spherical starch grains.

The powder is light yellow, with a tendency to cake in moist atmosphere and consisting of very irregular fragments; when examined under the microscope it exhibits numerous single crystals and bundles of long raphides of calcium oxalate; fragments of thin-walled, colorless parenchyma, frequently with dark intercellular spaces due to the inclusion of air; fragments with spiral or reticulate tracheæ are occasionally found.

Squill yields not more than 8 per cent. of ash.

Assay.—For a method for assaying Squill see Biological Assays (Chapter LXII).

U. S. P. Preparations.—Acetum Scillæ; Fluidextractum Scillæ; Syrupus Scillæ (from Vinegar); Syrupus Scillæ Compositus (from Fluidextract); Tinctura Scillæ.

N. F. Preparations.—Mistura Pectoralis, Stokes (from Fluidextract); Oxymel Scillæ (from Vinegar); Pilulæ Digitalis, Scillæ et Hydrargyri.

Squill contains the bitter principle *scillipicrin,* also *scillin,* and *scillitoxin* (*scillain*), a poisonous glucoside. There is also present a large quantity of mucilage analogous to dextrin, which Schmiedeberg calls *sinistrin* $(C_6H_{10}O_5)_n$; also calcium oxalate, etc. Water and alcohol extract its virtues.

Uses.—It is expectorant, emetic, and diuretic. Dose, two grains (0.13 Gm.).

DIGITALIS. U. S. Digitalis

[Digit.—Foxglove Digitalis folium P. I.]

The carefully dried leaves of *Digitalis purpurea* Linné (Fam. *Scrophulariaceæ*), without the presence or admixture of more than 2 per cent. of stems, flowers, or other foreign matter. If made into the official tincture and assayed biologically, the minimum lethal dose should not be greater than 0.006 mil of tincture, or the equivalent in tincture of 0.0000005 Gm. of ouabain, for each gramme of body weight of frog. Digitalis should be preserved in tightly-closed containers protected from light.

Official Description.—Leaves, when entire, attaining a length of 30 cm. and a breadth of 15 cm., ovate to oval, abruptly contracted into winged petioles, the latter from 5 to 10 cm. in length or, in the smaller leaves, nearly absent; margin crenate, irregular (the commercial article usually more or less crumpled and broken), thin, dull, pale green or gray and densely pubescent on the lower surfaces; upper surfaces wrinkled, sparsely hairy; the venation conspicuously reticulated; the midribs and principal veins broad and flat, often purplish, the lower veins continued into the wings of the petioles.

Odor and Taste.—Odor slight, characteristic; taste strongly bitter.

Tests for Identity and Purity.—The powder is dark green; with numerous fragments of non-glandular hairs consisting of from 2 to 8 cells (usually 2 to 5 cells), varying in length from 0.145 to 0.435 mm., some of the cells being frequently collapsed; glandular hairs few, small, with a 1- or 2-celled stalk and a 1- or 2-celled glandular head; numerous irregular fragments of lamina showing stomata and occasionally water-pores and elongated fragments of veins and petioles showing fibro-vascular tissues.

Digitalis yields not more than 15 per cent. of ash.

Assay.—For a method of assaying Digitalis see Biological Assays (Chapter LXII).

U. S. P. Preparations.—Fluidextractum Digitalis; Infusum Digitalis; Tinctura Digitalis.

N. F. Preparation.—Pilulæ Digitalis, Scillæ et Hydrargyri.

Digitalis has been the subject of exhaustive investigation. The constituents which are recognized as being of the greatest importance are *digitalin,* a glucoside, *digitonin,* a saponin-like body, *digitalein* (a mixture), and *digitoxin.* Other principles are also known, *digitoflavin, digitin, digitophyllin,* fat, etc. *Digitoxin,* $C_{34}H_{54}O_{11}$, is the chief active principle. It is given in a dose of 1/130 grain, but not more than 1/65 grain in twenty-four hours. Its effects must be carefully watched and the dose regulated accordingly. Much confusion exists concerning the commercial products sold as *digitalin.* The *French digitalin* of Nativelle (*Homolle's digitalin*) is very active; the dose is 1/250 to 1/40 grain. It must be used with caution. The *German digitalin* is chiefly digitonin, and is administered in a dose of 1/10 to 1/2 grain. *Digitalin, True* (*Schmiedeberg's Digitalin* or *Digitalinum Verum Kiliani*), $C_{35}H_{36}O_{14}$, is obtained commercially from German digitalin. Its dose is variable; 1/130 grain is usually given as the commencing dose. *Digitalein, crude,* is a mixture of glucosides from digitalis, prepared according to the process of Schmiedeberg. The dose is 1/60 to 1/30 grain, several times daily.

Uses.—Digitalis is used as a sedative and cardiac tonic, slowing and strengthening the heart beat. Dose, one grain (0.065 Gm.).

STROPHANTHUS. U. S. Strophanthus

[Strophanth.]

The dried, ripe seeds of *Strophanthus Kombe* Oliver, or of *Strophanthus hispidus* De Candolle (Fam. *Apocynaceæ*), deprived of the long awns. If made into the official tincture and assayed biologically, the minimum lethal dose should not be greater than 0.00006 mil of tincture, or the equivalent in tincture of 0.0000005 Gm. of ouabain, for each gramme of body weight of frog. Preserve Strophanthus in tightly-closed containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects.

Official Description.—Lance-ovoid, flattened and obtusely edged; from 7 to 20 mm. in length, about 4 mm. in breadth and about 2 mm. in thickness; externally of a light fawn color with a distinct, greenish tinge, silky lustrous from a dense coating of closely appressed hairs (*S. Kombe*); or light to dark brown, nearly smooth and sparingly hairy (*S. hispidus*), bearing on one side a ridge running from about the center to the summit; fracture short and somewhat soft, the fractured surface whitish and oily.

Odor and Taste.—Odor heavy when the seeds are crushed and moistened; taste very bitter.

Tests for Identity and Purity.—Under the microscope, sections of *Strophanthus Kombe* show a seed-coat composed of several layers of more or less collapsed, thin-walled cells and from the epidermal layer arise numerous non-glandular hairs, which are from 0.2 to 0.8 mm. in length, usually more or less bent, thin-walled, and slightly lignified at the base; in the rhaphe occurs a tangentially elongated fibro-vascular bundle having numerous spiral tracheæ; endosperm of from 9 to 30 rows of more or less polygonal cells with slightly thickened walls and containing small aleurone grains, a fixed oil, and strophanthin, the latter being colored bright green upon the addition of sulphuric acid; in the center occur two large plano-convex cotyledons having a distinct epidermal layer, a few fibro-vascular bundles and numerous parenchyma cells containing aleurone grains, a fixed oil, and occasionally a small amount of strophanthin.

Sections of *S. hispidus* resemble those of *S. Kombe*, the hairs being fewer and the bases more strongly lignified.

The powder is grayish-brown to dark brown; odor distinct; when examined under the microscope it exhibits chiefly thin-walled parenchyma cells and fragments of long, thin-walled hairs, the latter relatively few in *S. hispidus;* mounts made with hydrated chloral T.S. show numerous oil globules; upon the addition of sulphuric acid many of the fragments of the endosperm may be colored greenish.

Strophanthus yields not more than 5 per cent. of ash.

Assay.—For a method of assaying Strophanthus see Biological Assays (Chapter LXII).

Strophanthus contains a glucoside, *strophanthin,* kombic acid, fatty matter, resin, extractive, etc. Strophanthin is the active principle. Alcohol and water extract it. Purified petroleum benzin is used to percolate the drug to deprive it of the fatty matter before exhaustion with alcohol in making the tincture.

Uses.—Strophanthus is used as a sedative and cardiac stimulant in the dose of one grain (0.065 Gm.).

STROPHANTHINUM. U. S. Strophanthin

[Strophanthin.]

A glucoside or mixture of glucosides obtained from *Strophanthus Kombe* Oliver (Fam. *Apocynaceæ*). Preserve it in well-closed containers, protected from light.

Preparation.—This glucoside may be made by exhausting strophanthus with alcohol acidulated with hydrochloric acid, evaporating the liquid to a soft extract, treating this with water, and shaking the aqueous liquid with chloroform to remove the fatty matter; the aqueous liquid is evaporated to obtain the crystals of strophanthin.

Official Description.—A white or yellowish powder containing varying amounts of water, which it does not lose entirely without decomposition. It is permanent in the air. *Great caution must be used in tasting it and then only in very dilute solutions.*

Solubility.—Very soluble in water and in diluted alcohol, less soluble in dehydrated alcohol; nearly insoluble in chloroform, ether, or benzene.

Reaction and Tests for Identity.—Its solutions are neutral to litmus and are dextrorotatory.

Sulphuric acid added to Strophanthin produces an emerald-green color, changing to brown.

Add a trace of ferric chloride T.S. and a few mils of sulphuric acid to an aqueous solution of Strophanthin; a red-brown precipitate is produced which turns dark green after one or two hours.

Impurities and Tests for Impurities.—No weighable ash remains on incinerating 0.1 Gm. of Strophanthin.

A solution of 0.1 Gm. of Strophanthin in 15 mils of distilled water, when mixed with 5 mils of hot alkaline cupric tartrate V.S., produces no precipitate; but on heating an aqueous solution to 70° C. (158° F.), with a small amount of dilute hydrochloric acid (1 in 20), it is hydrolyzed into strophanthidin, which precipitates, and a sugar which remains in solution. The latter is capable of reducing alkaline cupric tartrate V.S.

U. S. P. Preparation.—Tinctura Strophanthi.

Uses.—Strophanthin is used as a cardiac stimulant in the following dose: by the mouth, 1/60 grain (0.001 Gm.); intravenous, 1/80 grain (0.00075 Gm.).

SANTONINUM. U. S. Santonin
[Santonin.]

The inner anhydride or lactone [$C_{15}H_{18}O_3 = 246.14$] of santonic acid obtained from *Artemisia pauciflora* (Ledebour) Weber (Fam. *Compositæ*). Preserve it in well-closed containers, protected from light.

Preparation.—It is prepared from santonica which contains santonin, *artemisin,* resin, volatile oil, gum, etc., and is made by exhausting the santonica mixed with lime, using diluted alcohol, distilling off the alcohol, and adding acetic acid to the residue. The precipitated santonin is purified by dissolving it in alcohol, treating with animal charcoal, and crystallizing. Santonin forms soluble compounds with alkalies, and it may be precipitated from its solutions by acids. Soluble compounds of santonin are unsuited for medicinal uses, because the comparative insolubility of santonin is one of its great advantages for use as an anthelmintic.

Official Description.—It occurs in colorless, shining, flattened rhombic prisms, or as a crystalline powder; permanent in the air; it becomes yellow on exposure to light. Santonin which has become yellow may be reconverted into colorless crystals by recrystallization from alcohol.

Odor and Taste.—Odorless, and nearly tasteless at first, but afterwards developing a bitter taste.

Solubility.—One Gm. of Santonin dissolves in 43 mils of alcohol, 1.7 mils of chloroform, and in 110 mils of ether at 25° C. (77° F.); also in 6.5 mils of boiling alcohol; very slightly soluble in water; slightly soluble in boiling water.

Tests for Identity and Purity.—Its solutions are neutral to litmus and are lævorotatory. It melts between 169° and 171° C. (336.2° and 339.8° F.).

Heat about 0.5 Gm. of Santonin with 5 mils of alcoholic potassium hydroxide T.S.; a red color is developed.

Shake about 0.01 Gm. of Santonin with a cooled mixture of 1 mil each of sulphuric acid and distilled water, heat the solution to 100° C. (212° F.), and add a minute trace of a very dilute solution of ferric chloride; a violet color results.

Incinerate about 1 Gm. of Santonin; not more than 0.1 per cent. of ash remains.

Readily Carbonizable Organic Impurities.—Two mils of sulphuric acid added to about 0.1 Gm. of Santonin produces not more than a faint, yellow color.

Alkaloids.—Boil about 2 Gm. of Santonin with 80 mils of distilled water and 5 mils of diluted sulphuric acid, allow the liquid to become cold and then filter it. The addition of mercuric potassium iodide T.S. or of iodine T.S. to 10 mils of the filtrate, mixed with 10 mils of distilled water, produces no cloudiness, even after standing for three hours.

N. F. Preparations.—Trochisci Santonini; Trochisci Santonini Compositi.

Uses.—Santonin is used as an anthelmintic, in doses of one to two grains (0.065 to 0.13 Gm.).

SANTALUM RUBRUM. U. S. Red Saunders

[Santal. Rub.]

The heart-wood of *Pterocarpus santalinus* Linné filius (Fam. *Leguminosæ*).

Official Description.—Usually in the form of a coarse powder, of a brownish-red or dark saffron color.

Odor and Taste.—Nearly odorless and tasteless.

Tests for Identity and Purity.—Under the microscope, Red Saunders shows numerous wood-fibers which are mostly irregular in outline, with sharply pointed and occasionally forked ends, the individual fibers from 0.3 to 0.75 mm. in length, the walls being very thick, porous, yellowish, unevenly thickened, and strongly lignified, and the lamina being filled with a fine, granular, protoplasmic content; occasionally tracheæ with simple or bordered pores and filled with light lemon-yellow, resinous masses; occasionally fragments showing medullary rays in narrow elliptical groups 1 cell wide and 3 to 6 cells deep; also occasional groups of crystal fibers with calcium oxalate in the form of monoclinic prisms, from 0.01 to 0.02 mm. in diameter. Mounts in hydrated chloral T.S. are of a deep, rich red color.

Add 0.5 Gm. of Red Saunders to 10 mils of alcohol; the solution becomes distinctly red. Add 0.5 Gm. of Red Saunders to 10 mils of ether; the solution assumes an orange-yellow color and when held in a bright light shows a distinct greenish fluorescence. Add 0.005 Gm. of Red Saunders to 10 mils of water; the liquid remains clear and colorless.

Red Saunders yields not more than 3 per cent. of ash.

U. S. P. Preparations.—Tinctura Lavandulæ Composita; Liquor Potassii Arsenitis (from Compound Tincture of Lavender).

Uses.—This wood contains *santalic acid* (*santalin*), a resinous substance, *pterocarpin*, and *santal*. It is used solely as a red coloring.

ADONIS. N. F. Adonis

[PHEASANT'S EYE]

The dried, overground portion of *Adonis vernalis* Linné (Fam. *Ranunculaceæ*), without the presence of more than 5 per cent. of foreign matter.

It contains *adonin*, or *adonidin*, also *aconitic acid*.

Official Description.—Glabrous, with the exception of the younger portions, which may be slightly grayish-puberulent; stems from 15 to 50 cm. in length, thick, but soft and weak; shining, simple or branched, the branches mostly from near the base and similar to the main stem; naked below, except for some scale-like leaf-vestiges, densely leafy above; leaves from 2 to 4 cm. in length and two-thirds or more as broad, pinnately divided into several segments, the larger of which are again divided, the ultimate segments being narrowly linear and acute; flowers terminal, yellow but usually drying to a cream color, from 3 to 6 cm. in breadth; sepals five, green or grayish-puberulent, more than half the length of the petals, oblong, obtuse, finely nerved petals from five to twenty, oblong, obtuse, finely nerved; stamens indefinite; pistils numerous, in fruit forming an ovoid, obtuse, dense head of ovoid akenes, which are tipped with the very small, persistent styles.

Odor and Taste.—Odor faint; taste bitterish, afterward somewhat acrid.

Tests for Identity and Purity.—The powdered drug is grayish-green and, when examined under the microscope, exhibits numerous fragments of pith parenchyma, the cells with few simple pores, up to 0.05 mm. in width and 0.25 mm. in length; groups of long narrow sclerenchyma fibers, mostly with lignified walls from 0.005 to 0.007 mm. in thickness and having a few rounded or oblique simple pores; tracheæ spiral or with bordered pores and up to 0.017 mm. in width; epidermal cells from the stem and petiole, elongated in surface view and with elliptical stomata, the latter about 0.064 mm. in length; fragments of the epidermal tissue from the lamina of the leaf, composed of finely striated cells with wavy, vertical walls, associated with broadly elliptical stomata, the latter up to 0.047 mm. in length; brownish colored fragments from the scales at the base of the stem, composed of elongated cells with somewhat rounded ends and yellowish-brown walls; starch grains and calcium oxalate crystals few or absent.

Adonis yields not more than 12 per cent. of ash.

N. F. Preparation.—Fluidextractum Adonidis.

Uses.—A substitute for digitalis, slowing the heart and increasing the heart beat. It is also used as a diuretic. Dose, two grains (0.13 Gm.).

ALETRIS. N. F. Aletris

[**Aletr.**—Unicorn Root Star Grass]

The dried rhizome and roots of *Aletris farinosa* Linné (Fam. *Liliaceæ*).

It contains a bitter principle and large amounts of starch.

Official Description.—Rhizome horizontal or slightly oblique, nearly cylindrical or laterally compressed above, from 2 to 4 cm. in length and from 5 to 12 mm. in diameter; externally grayish-brown, upper portion with circular stem scars from 3 to 7 mm. in diameter and with numerous leaf bases, the sides and lower portion with numerous tough, wiry, whitish or reddish-brown roots which are more or less flexuous and provided with short branches; fracture short; internally light brown, cortex from 1 to 2 mm. in thickness, central cylinder with numerous twisted and branching fibro-vascular bundles.

Odor and Taste.—Odor slight, acetous; taste sweetish, somewhat bitter.

Tests for Identity and Purity.—Examined microscopically, the greater part of the drug is found to consist of parenchyma cells filled with spherical or ellipsoidal starch grains, from 0.008 to 0.016 mm. in diameter. Some of the parenchyma cells contain rhaphides, the latter being from 0.025 to 0.045 mm. in length. The tracheæ are reticulate or provided with simple pores and around these are several layers of lignified cells with thick walls and simple, large oblique pores. The endodermis is composed of several layers of thick-walled and closely-lamellated cells of a deep yellow color and the cortex is readily separated.

Aletris yields not more than 16 per cent. of ash.

N. F. Preparations.—Elixir Viburni Opuli Compositum; Fluidextractum Aletridis.

Uses.—It is used as a diuretic, uterine tonic, and antirheumatic. Dose, thirty grains (2 Gm.).

BRAYERA. N. F. Brayera

(U. S. P. VIII)

[**Brayer.**—Kousso Cusso]

The dried panicles of the pistillate flowers of *Hagenia abyssinica* (Bruce) Gmelin (Fam. *Rosaceæ*), without the presence of more than 10 per cent. of the staminate flowers, other parts of the tree, or other foreign matter. Reject any portions of the stems over 3 mm. in diameter and any binding material, before the drug is powdered or used.

It contains a bitter, resinous principle, *kosin*, $C_{31}H_{38}O_{10}$, about 24 per cent. of tannin, volatile oil, gum, etc.

Official Description.—Usually in rolls or flattened bundles from 25 to 50 cm. in length, reddish-brown, or occurring more or less loose and stripped from the larger portions of the panicles. Panicle branches cylindrical, somewhat flattened, longitudinally furrowed or wrinkled, externally light brown to yellowish, tomentose, glandular; internally, cork brownish, bast- and wood-fibers yellow, fibro-vascular bundles in wedges, pith large and yellowish-brown; nodes distinct, each with a scar or branch and subtended by a sheathing bract; internodes mostly from 1 to 2 cm. in length; flowers subtended by two ovate, reddish, pubescent and glandular bracts; pedicel short; calyx turbinate, pubescent below, subtended by four or five rigid, spreading, obovate, purple-veined bractlets which are persistent and elongated in fruit, alternating with and larger than the five usually shriveled, reflexed calyx lobes; petals five, caducous, and usually absent in the drug; carpels two; styles exserted, stigmas broad and hairy with prominent papillæ; fruit an ovoid akene about 2 mm. in diameter, enclosed by the remains of the calyx. The staminate flowers are greenish-yellow, with about twenty fertile stamens.

Odor and Taste.—Odor slight; taste bitter.

Tests for Identity and Purity.—The powdered drug is light brown or reddish-brown and, when examined under the microscope, exhibits numerous simple, non-glandular, straight or curved hairs, up to about 1 mm. in length, with thick, strongly lignified walls, usually enlarged at the base; glandular hairs with one- to three-celled stalks, the glandular head unicellular or consisting of one or two pairs of cells; tracheæ spiral, annular scalariform or with bordered pores, up to 0.05 mm. in width; sclerenchymatous fibers long, thick-walled, strongly lignified and with numerous, simple, oblique pores; parenchyma of pith more or less lignified and with large simple pores; fragments of epidermal tissue from the bracts and calyx with elliptical stomata up to 0.03 mm. in length; groups of thin-walled, somewhat branching parenchyma cells with large intercellular spaces; tissue from the inner surface of the pericarp consisting of numerous, elongated, porous, strongly lignified cells; calcium oxalate in rosette aggregates up to 0.04 mm. in diameter; occasionally fragments of tissue containing prisms of calcium oxalate, the latter about 0.014 mm. in length; pollen grains few, nearly spherical, from 0.025 to 0.04 mm. in diameter, with three pores. The larger branches of the panicles exhibit simple, non-glandular hairs up to about 5 mm. in length; tracheæ up to 0.125 mm. in width and rosette aggregates of calcium oxalate up to about 0.075 mm. in diameter.

Brayera yields not more than 9 per cent. of ash.

N. F. Preparation.—Infusum Brayeræ.

Uses.—It is used as an anthelmintic. Dose, one-half ounce (15 Gm.).

CAULOPHYLLUM. N. F. Caulophyllum

[**Cauloph.**—Blue Cohosh Papoose Root Squaw Root]

The dried rhizome and roots of *Caulophyllum thalictroides* (Linné) Michaux (Fam. *Berberidaceæ*).

It contains a glucoside, *leontin,* also said to contain an alkaloid, *caulophylline,* resin, starch, etc.

Official Description.—Rhizome of horizontal growth, from 7 to 25 cm. in length and from 5 to 15 mm. in thickness, much branched, slightly compressed from above, bearing large cup-shaped stem scars on the upper surface, underneath a tangled or matted mass of long, curved, thin tough roots which frequently conceal the rhizome; both rhizome and roots of a grayish or yellowish-gray color; fracture tough and woody.

Odor and Taste.—Odorless but sternutatory; taste bitter-sweet and acrid.

Tests for Identity and Purity.—The powdered drug is light brown and, when examined under the microscope, it exhibits numerous starch grains, spherical in outline, mostly simple, up to 0.016 mm. in diameter; fragments of cork with cells about 0.05 mm. in diameter and having yellowish-brown walls; tracheæ with bordered pores, the cells being up to 0.05 mm. in width; wood-fibers with heavily lignified walls; fragments of parenchyma tissue with many of the cells containing starch grains.

Caulophyllum yields not more than 6 per cent. of ash.

N. F. Preparation.—Fluidextractum Caulophylli.

Uses.—It is used as an antispasmodic, diuretic, and emmenagogue. Dose, eight grains (0.5 Gm.).

CENTAURIUM. N. F. Centaury

[**Centaur.**]

The dried flowering plant of *Erythræa Centaurium* (Linné) Persoon (Fam. *Gentianaceæ*).

It contains a bitter glucoside similar to those in gentian and chirata.

Official Description.—Glabrous, from 1.5 to 5 dm. in height, much branched from the base, but little branched, if at all, from above; stems slender, sharply angled or narrowly winged, sparsely leafy; leaves opposite, entire, mostly three-nerved, sessile, those at the base obovate and obtuse, from 2 to 5 cm. in length, their base narrowed and petiole-like, those of above gradually changing to oval, then ovate or even lance-linear, acute; flowers in a terminal and at length compound cyme, rose-colored; calyx from 5 to 7 mm. in length, deeply five-parted, the tube short, sharply angled, lobes linear-attenuate with a sharp midrib; corolla tube nearly twice the length of the calyx, slender, the limb from 10 to 15 mm. in breadth, its lobes broadly oblong or oval; stamens five, exserted, bright-yellow, their anthers twisted when old; pistil two-carpelled.

Odor and Taste.—Odor faint but characteristic; taste persistently bitter.

Test for Identity and Purity.—Centaury yields not more than 5 per cent. of ash.

N. F. Preparation.—Tinctura Amara.

Uses.—It is a bitter tonic. Dose, thirty grains (2 Gm.).

CHIONANTHUS. N. F. Chionanthus

[**Chionant.**—Fringe Tree Bark]

The dried bark of the root of *Chionanthus virginica* Linné (Fam. *Oleaceæ*), without the presence of more than 8 per cent. of other parts of the plant or other foreign matter.

It contains a bitter principle and probably saponin.

Official Description.—Usually in transversely curved pieces, occasionally in single quills from 1 to 10 cm. in length; bark from 2 to 10 mm. in thickness; heavy, some pieces of the whole drug sinking when thrown into water; outer surface usually reddish-brown, occasionally grayish-brown, with few transverse wrinkles, whitish cork patches and root scars; inner surface yellowish-brown, more or less striate and undulate; fracture short, hard, and coarsely granular, due to projecting groups of stone cells; the broken surface of a light yellowish-white color.

Odor and Taste.—Odor characteristic; taste bitter.

Tests for Identity and Purity.—The powdered drug is light brown and, when examined under the microscope, exhibits somewhat rounded, simple or two- to four-compound starch grains, the indivdual grains mostly 0.003 to 0.025 mm. in diameter; numerous stone cells, in groups and isolated, the walls thick, strongly lignified and with simple and branching pores; brown resin masses; fragments consisting of light brown, thin-walled cork cells; parenchyma tissue with many of the cells filled with starch grains.

Chionanthus yields not more than 5 per cent. of ash.

N. F. Preparation.—Fluidextractum Chionanthi.

Uses.—It has been used as a diuretic in hepatic and syphilitic disorders.

CHIRATA. N. F. Chirata

(U.S.P. VIII)

[**Chirat.**]

The dried plant of *Swertia Chirayita* (Roxburgh) Hamilton (Fam. *Gentianaceæ*). It contains a bitter glucoside, *chiratin*, $C_{26}H_{48}O_{15}$, and a bitter principle, $C_{13}H_{20}O_{10}$.

Official Description.—Smooth, root simple, about 7 mm. in thickness near the crown stem about 1 M. in length, externally yellowish- or purplish-brown; cylindrical near the base, quadrangular and slightly winged above, with numerous opposite, ascending branches; wood yellowish, thin, enclosing usually a large yellowish easily separable pith; leaves opposite, sessile, ovate-lanceolate, entire, five-nerved, about 6 cm. in length; flowers numerous, panicled, small, with a four-lobed calyx and corolla, capsule ovoid, acute, one-celled, many-seeded.

Odor and Taste.—Odor slight; taste intensely bitter.

Tests for Identity and Purity.—Chirata yields not more than 6 per cent. of ash.

N. F. Preparation.—Fluidextractum Chiratæ.

Uses.—It is used as a tonic and febrifuge. Dose, fifteen grains (1 Gm.).

COCILLANA. N. F. Cocillana
[Cocillan.]

The dried bark of *Guarea Rusbyi* (Britton) Rusby (Fam. *Meliaceæ*).

It contains resins and an active principle claimed by some to be an alkaloid, by others to be a glucoside.

Official Description.—In flat or curved pieces of variable size and from 3 to 5 mm. in thickness; outer surface shallowly or deeply fissured, according to age and thickness, gray-brown, often ashy-gray from lichen growths, or of a deeper brown where the cork has been removed; inner surface of medium brown color, strongly and coarsely longitudinally striate, the striæ straight or wavy; inner bark usually much thicker than the outer, its fracture coarsely splintery-fibrous.

Odor and Taste.—Odor characteristic; taste slightly astringent, peculiar and slightly nauseous.

Test for Identity and Purity.—Cocillana yields not more than 10 per cent. of ash.

N. F. Preparation.—Fluidextractum Cocillanæ.

Uses.—It is used as a stimulant, expectorant, and cathartic; similar to ipecac in many respects. Dose, fifteen grains (1 Gm.).

CONDURANGO. N. F. Condurango
[Conduran.]

The dried bark of *Marsdenia Condurango* (Triana) Reichenbach filius (Fam. *Asclepiadaceæ*).

It contains resin, tannin, and a bitter glucoside, *condurangin*. *Conduransterin*, cinnamic acid, and a minute quantity of an alkaloid are also said to be present.

Official Description.—In quills or transversely curved pieces, usually from 4 to 13.5 cm. in length; bark 1 to 6 mm. in thickness; outer surface light grayish-brown to dark brown, nearly smooth and with numerous lenticels, or more or less scaly and considerably roughened; the scales soft, occasionally with brownish-black apothecia of a fungus; inner surface grayish-white or light brown, longitudinally striate; fracture short-fibrous and granular.

Odor and Taste.—Odor slightly aromatic, especially marked in the fresh drug; taste bitter and aromatic.

Tests for Identity and Purity.—Under the microscope, sections of Condurango show a corky layer consisting of several rows of thin-walled cells, frequently with yellowish-brown contents; a layer of phelloderm of eight to ten rows of cells, containing starch grains and membrane crystals of calcium oxalate, the latter in prisms, from 0.01 to 0.035 mm. in length; a primary cortex of collenchyma containing chloroplastids, starch grains or rosette aggregates of calcium oxalate, from 0.015 to 0.04 mm. in diameter; a pericycle or pericambium of tangentially elongated parenchyma cells, with groups of bast-fibers and laticiferous vessels in an interrupted circle; middle bark with large groups of stone cells varying from nearly isodiametric to elongated, sometimes very irregular in form; inner bark with medullary rays one or two cells in width, numerous laticiferous cells accompanied by small groups of sieve cells, parenchyma containing either starch grains or rosette aggregates of calcium oxalate, and an occasional isolated bast-fiber or small group of stone cells.

The powder is light yellowish-brown, consisting chiefly of groups of stone cells and parenchyma containing calcium oxalate crystals and starch grains; stone cells chiefly in large groups, the individual cells being more or less irregular in shape and with very thick porous walls, the lamina being usually filled with air; calcium oxalate chiefly in rosette aggregates, occasionally in single prisms, mostly from 0.015 to 0.02 mm. in diameter; starch grains mostly simple, frequently two- to four-compound, the individual grains being from 0.003 to 0.015 mm. in diameter; bast-fibers non-lignified; very long and from 0.01 to 0.035 mm. in width; fragments of thin-walled latex tubes from 0.015 to 0.025 mm. in diameter and filled with a granular substance; fragments of cork grayish or light yellowish-brown.

Macerate 1 Gm. of the powdered bark in 5 mils of cold water; filter and heat the filtrate in a test tube; it becomes cloudy, but on cooling assumes its original transparency.

Condurango yields not more than 12 per cent. of ash.

N. F. Preparation.—Fluidextractum Condurango.

Uses.—It is used as an alterative and stomachic. Dose, one drachm (4 Gm.).

CONVALLARIÆ FLORES. N. F. Convallaria Flowers

[Convallar. Flor.—LILY-OF-THE-VALLEY FLOWERS]

The dried inflorescence of *Convallaria majalis* Linné (Fam. *Liliaceæ*), without the presence of more than 5 per cent. of foreign matter.

It contains a volatile crystalline principle. Other constituents similar to those in the root, but in smaller amounts.

Official Description.—From 15 to 25 cm. in length, peduncle dull-green or suggesting purplish-green, and more or less angled; flowers white, when old drying to a brownish color, usually from ten to twenty in number, borne in a more or less secund raceme on recurved pedicels which are usually from a half longer than their flowers to twice their length, each pedicel subtended by a whitish, ovate, acute bract about half its length; flowers from 6 to 8 mm. in length and rather broader, bell-shaped, six-parted, the segments ovate, obtuse, and slightly recurved; stamens six, included, adnate to the base of the corolla; style columnar, three-grooved.

Odor and Taste.—Odor agreeable; taste sweetish, then somewhat acrid.

Tests for Identity and Purity.—The powdered drug is light yellowish-brown and, when examined under the microscope, exhibits ellipsoidal or nearly spherical pollen grains with a smooth exine layer and occasionally with a convex rupture through the walls; calcium oxalate in rhapides up to 0.04 mm. in length; fragments of tissue from the corolla composed of nearly isodiametric parenchyma cells with broadly elliptical stomata up to 0.04 mm. in length; fragments from the anther lobes, many of the cells having reticulate walls; few fragments of the short filaments with cells containing calcium oxalate; fragments of the stigma, rough and warty, with adhering pollen grains; portions of the bracts composed of thin-walled elongated cells, a few vascular bundles and stomata; tissue of the peduncle and pedicel composed of fragments of the epidermis with cells tapering at each end about 0.20 mm. in length and 0.03 mm. in breadth with elliptical stomata between the ends; sub-epidermal cells with yellowish-green plastids; tracheæ about 0.021 mm. in width, spiral and with simple pores; sclerenchymatous fibers few, with lignified walls and simple pores.

Convallaria Flowers yield not more than 12 per cent. of ash.

N. F. Preparation.—Fluidextractum Convallariæ Florum.

Uses.—Similar to those given under the root. Dose, eight grains (0.5 Gm.).

CONVALLARIÆ RADIX. N. F. Convallaria Root

(U. S. P. VIII)

[Convallar. Rad.—LILY-OF-THE-VALLEY ROOT]

The dried rhizome and roots of *Convallaria majalis* Linné (Fam. *Liliaceæ*).

This drug contains *convallarin*, a glucoside, which is split into *convallaretin* and glucose by the action of dilute acids; it also contains another glucoside, *convallamarin* ($C_{23}H_{44}O_{12}$), which is the active principle. The fluidextract is the best preparation.

Official Description.—Rhizome horizontal, elongated, usually branched, cylindrical, variable in length, from 1 to 3 mm. in diameter; externally yellowish-white or pale brown, with a few circular stem scars, and from the under and side portions at the nodes usually arise from three to five thin, tortuous, dark brown, branching roots; fracture short or fibrous; internally whitish.

Odor and Taste.—Odor faint; taste sweetish, becoming bitter and acrid.

Tests for Identity and Purity.—Under the microscope, transverse sections of the rhizome of Convallaria Root show an epidermal layer with a thick outer layer of cutin; a hypodermal layer of a single row of collenchyma; a cortex made up of about twenty rows of parenchyma cells, some of which contain starch and rhaphides of calcium oxalate; a prominent endodermis, the radial and inner walls of which are strongly thickened and lignified; inside the endodermis is an interrupted circle of collateral fibro-vascular bundles, the woody portion of which has in cross section the shape of the letter V; inside the circle of bundles is another interrupted circle of fibro-vascular bundles of the concentric type, the sieve tissue being surrounded by the xylem; the parenchyma cells of the pith separated by large intercellular spaces.

Under the microscope, transverse sections of the root of Convallaria show a hairy epidermal layer, a hypodermis of a single row of cells; a cortex of about six rows of cells, some of which contain starch, rhaphides of calcium oxalate, and oil; the cells of the endodermal layer resemble those of the rhizome; fibro-vascular bundles mostly five.

The powder is dark brown, tending to cake on standing, consisting chiefly of cellular fragments and a few starch grains and rhaphides of calcium oxalate; cells of endodermis with slightly oblique ends and considerably thickened, lignified porous walls; fragments of tracheæ with spiral and scalariform thickenings, or with porous walls; starch grains single or compound, mostly nearly spherical, and from 0.003 to 0.012 mm. in diameter; rhaphides of calcium oxalate few, from 0.02 to 0.045 mm. in length.

Convallaria Root yields not more than 10 per cent. of ash.

N. F. Preparation.—Fluidextractum Convallariæ Radicis.

Uses.—Convallaria is a valuable sedative and cardiac stimulant, and is often used in place of digitalis. Dose, eight grains (0.5 Gm.).

CORNUS. N. F. **Cornus**

[**Corn.**—Dogwood Bark]

The dried bark of the root of *Cornus florida* Linné (Fam. *Cornaceæ*).

It contains a bitter principle, *cornin,* or *cornic acid,* resin, fixed oil, tannin, etc.

Official Description.—In irregular, chip-like pieces, or portions of quills, usually less than 5 cm. in length and from 1 to 4 mm. in thickness; externally of a dingy-brown color, lightly fissured and thinly scaly, or reddish where the corky layer has been removed; inner surface varying from pinkish-brown to red-purple, usually harsh to the touch from numerous short striæ; fracture short, the surface whitish with yellow striæ, except the inner layer, which is light purple.

Odor and Taste.—Odor slight; taste bitter and astringent.

Test for Identity and Purity.—Cornus yields not more than 10 per cent. of ash.

N. F. Preparation.—Fluidextractum Corni.

Uses.—It is a mild astringent, stomachic, and antiperiodic. Dose, thirty grains (2 Gm.).

CROCUS. N. F. **Crocus**

[**Croc.**—Saffron]

The stigmas of *Crocus sativus* Linné (Fam. *Iridaceæ*), without the presence of more than 10 per cent. of the yellow styles or other foreign matter. Preserve it in tightly-closed containers, protected from light.

It contains a bitter principle, *piro-crosin,* or *saffron-bitter,* $C_{38}H_{66}O_{17}$, and *crocin,* $C_{44}H_{70}O_{28}$, a glucoside. It also contains volatile oil.

Official Description.—Stigmas 3, united or separate, attached to the summit of the style; usually about 25 mm. in length, cornucopia-shaped, of a dark, rich red color, the margin dentate or fimbriate; styles about 10 mm. in length, more or less cylindrical, solid, yellowish.

Odor and Taste.—Odor strong, peculiarly aromatic; taste bitterish, aromatic. When chewed it colors the saliva orange-yellow.

Tests for Identity and Purity.—Under the microscope, the upper end of the stigma shows numerous cylindrical papillæ about 0.15 mm. in length, among which occur a few spherical pollen grains, the latter being nearly smooth, and from 0.04 to 0.07 mm. in diameter; occasionally some of the pollen grains have germinated and show pollen tubes.

When placed in sulphuric acid, the stigmas are immediately colored blue, gradually changing to violet, and finally become a deep wine-red color.

Add 0.01 Gm. of finely powdered Crocus to 100 mils of cold water, allow it to macerate for several hours and filter; on adding 10 mils of this filtrate to 100 mils of water, it gives a distinctly yellow-colored solution.

Macerate 0.01 Gm. of Crocus in 5 mils of methyl alcohol; a deep orange color is imparted to the liquid. Macerate 0.01 Gm. of Crocus in 5 mils of acetone, alcohol, or dehydrated alcohol; a distinct, lemon-yellow color is produced. With corresponding quantities of Crocus and ether a very light lemon-yellow color is produced. With corresponding quantities of Crocus and chloroform a very slight, yellow tinge is imparted and with corresponding portions of Crocus and xylene, benzene, carbon disulphide, or carbon tetrachloride, the solvents remain colorless.

When Crocus is pressed between filter paper, the paper does not display transparent spots due to the absorption of oil.

It loses not more than 14 per cent. of its weight when dried at 100° C. (212° F.).

Crocus yields not more than 7.5 per cent. of ash and the ash is not fusible.

N. F. Preparations.—Pilulæ Antiperiodicæ; Pilulæ Antiperiodicæ sine Aloe; Tinctura Antiperiodica; Tinctura Antiperiodica sine Aloe; Tinctura Croci; Tinctura Opii Crocata; Tinctura Zedoariæ Amara.

Uses.—It has been used as an anodyne, antispasmodic, and emmenagogue, but is of little value. It is also used as a coloring agent.

FARFARA. N. F. Coltsfoot

[**Farfar.**—Coltsfoot Leaves Tussilago Leaves]

The dried leaves of *Tussilago Farfara* Linné (Fam. *Compositæ*), without the presence of more than 5 per cent. of other parts of the plant or other foreign matter.

It contains a bitter glucoside, tannin, resin, gum, etc.

Official Description.—Petioles long, pubescent; blades very brittle, nearly orbicular or broadly ovate-reniform, from 8 to 15 cm. in length and nearly as broad, deeply cordate at the base, angulately lobed and dentate with red-brown teeth, palmately five- to nine-veined; young leaves white floccose all over, the older leaves with upper surfaces dark green and nearly smooth, the younger densely white floccose.

Odor and Taste.—Odor indistinct; taste mucilaginous, faintly herbaceous, bitter.

Tests for Identity and Purity.—The powder, when examined under the microscope, exhibits numerous multicellular, non-branching hairs, usually curved and twisted together, the lower cells about 0.035 mm. in width, the terminal cells much elongated, about 0.012 mm. in width and at times with spiral bands; broadly elliptical stomata about 0.05 mm. in length and associated with finely striated epidermal cells, the latter having wavy vertical walls; non-porous sclerenchymatous fibers few with walls from 0.006 to 0.1 mm. in thickness; parenchyma cells containing chloroplastids; tracheæ few, spiral, annular or with simple pores.

Coltsfoot yields not more than 20 per cent. of ash.

N. F. Preparation.—Species Pectorales.

Uses.—It is used as a demulcent and tonic. Dose, one drachm (4 Gm.).

FRAXINUS. N. F. White Ash Bark

[**Fraxin.**]

The dried bark of *Fraxinus americana* Linné (Fam. *Oleaceæ*), and probably of other species of *Fraxinus*, deprived of the corky layer. It contains a bitter glucoside, *fraxin*, $C_{16}H_{18}O_{10}$, and also *fraxetin*, $C_{10}H_8O_5$, tannin, etc.

Official Description.—In flat pieces of varying length and width, from 3 to 6 mm. in thickness, externally yellowish or pale brown, sometimes with ridges of a warty nature and fissures of a grayish-brown color with markings of lichens; inner surface pale brown to yellowish, longitudinally striate; fracture very uneven, fibrous.

Odor and Taste.—Odor faintly aromatic; taste bitter, weakly acrid.

Test for Identity and Purity.—Fraxinus yields not more than 10 per cent. of ash.

N. F. Preparation.—Vinum Fraxini.

Uses.—It is a bitter tonic, antiperiodic, and astringent. Dose, thirty grains (2 Gm.).

GOSSYPII CORTEX. N. F. Cotton Root Bark

(U.S.P. VIII)

[Gossyp. Cort.]

The recently-gathered air-dried bark of the root of one or more of the cultivated varieties of *Gossypium herbaceum* Linné, *Gossypium Barbadense* Linné, or *Gossypium arboreum* Linné (Fam. *Malvaceæ*), without the presence of more than 5 per cent. of wood or other foreign matter.

It contains a yellow resin, *chromogene,* which becomes red on exposure to air, also fixed oil, tannin, starch, sugar, etc.

Official Description.—In flexible bands or quilled pieces, attaining a length of 30 cm. and a thickness of about 1 mm.; outer surface orange-brown, smooth, slightly wrinkled, with small circular lenticels, the outer corky layer frequently exfoliated and showing the more or less fissured and fibrous middle bark; inner surface light brown, longitudinally striate; fracture tough, fibrous, the inner bark readily separable into fibrous layers.

Odor and Taste.—Odor slight; taste very slightly acrid.

Tests for Identity and Purity.—Under the microscope, sections of Cotton Root Bark show an outer layer of cork composed of four to six layers of tabular, thin-walled, yellowish-brown, non-lignified cells; a thin primary cortex, consisting of starch-bearing parenchyma and an occasional large secretion reservoir with yellowish-brown contents; inner bark with large groups of bast-fibers arranged in interrupted, concentric circles, separated radially by medullary rays and tangentially by the leptome or sieve tissue; bast-fibers from 0.3 to 1 mm. in length and about 0.015 mm. in width, the walls being about 0.005 mm. in thickness, strongly lignified and with very few pores, the ends being acute and markedly attenuate; medullary rays one to six cells wide, the cells usually filled with starch grains; the latter from 0.003 to 0.02 mm. in diameter; occasional cells containing rosette aggregates of calcium oxalate from 0.009 to 0.025 mm. in diameter.

Cotton Root Bark yields not more than 7 per cent. of ash.

N. F. Preparation.—Fluidextractum Gossypii Corticis.

Uses.—It is used as an emmenagogue. The fresh bark, which is now official, is said to be much more active than old bark. Dose, thirty grains (2 Gm.).

HELONIAS. N. F. Helonias

[Helon.—False Unicorn]

The dried rhizome and roots of *Chamælirium luteum* (Linné) A. Gray (Fam. *Liliaceæ*).

It contains about 10 per cent. of an amorphous glucoside, *chamælirin,* soluble in alcohol and water. With acids this yields *chamæliretin.*

Official Description.—Rhizome upright, or oblique, nearly cylindrical, from 0.5 to 3 cm. in length and about 1 cm. in diameter; externally grayish-brown, annulate from scars of bud-scales; upper portion with leaf bases enclosing a small bud; oblique rhizomes with a few stem scars about 0.5 mm. in diameter; lower portion with numerous whitish or pale yellowish, nearly straight or slightly curved wiry roots, from 5 to 8 cm. in length; fracture hard and horny; internally grayish-yellow, cortex from 3 to 4 mm. in thickness, central cylinder with three or four circles of small, nearly circular fibro-vascular bundles.

Odor and Taste.—Odor distinctive; taste bitter, slightly astringent.

Tests for Identity and Purity.—Sections of the rhizome, when examined under the microscope, show parenchyma cells with numerous spherical or ellipsoidal starch grains, varying from 0.002 to 0.015 mm. in diameter; numerous rhaphides varying from 0.025 to 0.035 mm. in length; the fibro-vascular bundles vary from 0.2 to 0.3 mm. in diameter, the tracheæ being at the periphery and the walls marked either with annular or reticulate thickenings or simple pores. In the root the cortex is always attached and there are usually six mestome strands.

Helonias yields not more than 5 per cent. of ash.

N. F. Preparation.—Fluidextractum Heloniadis.

Uses.—It is used in dropsy and also as a vermifuge in tape worm. Dose, thirty grains (2 Gm.).

HYDRANGEA. N. F. Hydrangea

[**Hydrang.**—SEVEN-BARKS]

The dried rhizome and roots of *Hydrangea arborescens* Linné (Fam. *Saxifragaceæ*).

It contains about 1 per cent. of a glucoside, *hydrangin,* said to have the formula $C_{34}H_{25}O_{11}$.

Official Description.—Rhizome cylindrical, usually cut into pieces from 3 to 10 cm in length and from 3 to 20 mm. in diameter; externally light brown to yellowish-brown with a pinkish tinge, longitudinally wrinkled, marked by few elliptical lenticels and occasional prominent buds, short branches or stem scars; from the lower surface arise a few coarse fibrous roots; fracture tough, splintery; internally yellowish-white or light brown, bark thin, easily separable from the distinctly radiate wood which surrounds a prominent whitish pith. Roots attaining a length of 25 cm. and a thickness of 2 mm., irregularly bent and branching, otherwise resembling the rhizome with the exception of the pith being absent.

Odor and Taste.—Inodorous; taste sweetish, becoming slightly acrid.

Tests for Identity and Purity.—Under the microscope, sections of the rhizome of Hydrangea show a gray cork of a few rows of tabular cells, a cortex made up chiefly of parenchyma containing starch, large cells containing rhaphides and small isolated groups of stone cells or sclerenchymatous fibers; a woody cylinder composed of slender wedges made up of prominent tracheæ with reticulate thickenings and tracheids separated by medullary rays one to three cells wide, the cells of which are filled with small starch grains; pith of large polygonal cells with prominent simple pores.

The powder is light yellowish-brown, containing irregular fragments consisting of strongly lignified tracheæ, tracheids and medullary ray cells; stone cells and sclerenchymatous fibers from 0.05 to 0.2 mm. in length, strongly lignified, the walls marked by simple and branching pores; rhaphides numerous, from 0.07 to 0.13 mm. in length; starch grains mostly single, more or less ellipsoidal, occasionally with a prominent central cleft and varying from 0.002 to 0.01 mm. in diameter.

Hydrangea yields not more than 3 per cent. of ash.

N. F. Preparation.—Fluidextractum Hydrangeæ.

Uses.—It is used as a diuretic and narcotic. Dose, thirty grains (2 Gm.).

MELILOTUS. N. F. Melilot

[**Melilot.**—YELLOW MELILOT YELLOW SWEET CLOVER]

The dried leaves and flowering tops of *Melilotus officinalis* (Linné) Lamarck (Fam. *Leguminosæ*).

It contains *cumarin* and has a pungent, bitterish taste.

Official Description.—Stems mostly less than 3 dm. in length, slender, straight, mostly simple, often leafy below, terminating in long, slender racemes, the younger portions very finely pubescent; leaves glabrous or nearly so; petiolate, trifoliate, stipulate, the stipules subulate, entire, the leaflets from 1 to 3 cm. in length, varying from narrowly oblong to oval or occasionally broader above the middle, rounded, truncate, or slightly notched at the summit, sharply serrate; racemes 1 dm. or less in length, many flowered, the flowers yellow, from 5 to 6 mm. in length; calyx bell-shaped, the fine nearly equal lobes shorter than the tube, corolla papilionaceous, the keel shorter than the other petals, which are about equal; legumes reflexed, from 2.5 to 3.5 mm. in length, obovate, wrinkled, one-seeded.

Odor and Taste.—Odor aromatic, tonka-like; taste sweetish, slightly pungent and bitter.

Test for Identity and Purity.—Melilot yields not more than 10 per cent. of ash.

N. F. Preparation.—Species Emollientes.

Uses.—It is used in diarrhœa, dysmenorrhœa, and rheumatism.

PHYTOLACCA. N. F. Phytolacca

(U.S.P. VIII)

[**Phytolac.**—POKE ROOT]

The dried root of *Phytolacca decandra* Linné (Fam. *Phytolaccaceæ*), collected in the autumn.

It contains an amorphous, bitter, and acrid glucosidal substance, similar to saponin, which is the most active substance. There is present also a small amount of an alkaloid, *phytolaccine,* and *phytolaccic acid.*

Official Description.—Cylindrical, somewhat tapering, sparingly branched, from 3 to 7 cm. in thickness, mostly in transverse or longitudinal slices; externally yellowish-brown, finely longitudinally or spirally wrinkled and thickly annulate with lighter colored, low ridges; fracture fibrous, characterized by alternating layers of fibro-vascular tissue and parenchyma, the layers of the latter being much retracted.

Odor and Taste.—Odor slight; taste sweetish, afterwards highly acrid.

Test for Identity and Purity.—Phytolacca yields not more than 14 per cent. of ash.

N. F. Preparation.—Fluidextractum Phytolaccæ.

Uses.—It is used as an alterative, in doses of two grains (0.13 Gm.), and as an emetic, in doses of fifteen grains (1 Gm.).

VERBENA. N. F. Verbena

[**Verben.**—BLUE VERVAIN]

The dried overground portion of *Verbena hastata* Linné (Fam. *Verbenaceæ*), collected when flowering.

It is said to contain a bitter glucoside, but has not been carefully investigated.

Official Description.—In broken or cut pieces; stem stout, obtusely quadrangular, rough, pubescent; leaves opposite, petioles from 12 to 25 mm. in length, blades from 6 to 12 cm. in length, lanceolate, acuminate, acute, coarsely and sharply serrate or the lower hastate lobed, deep green above, paler beneath, conspicuously veined; flowers in terminal interrupted panicles of spikes, spikes erect cylindraceous, densely flowered, each flower subtended by a lanceolate acute bract; calyx adherent, little more than half the length of the corolla, tubular, five-lobed, the mouth slightly oblique; corolla small, bright blue, salver-form tube externally pubescent, sub-equally five-lobed; stamens adnate to the corolla tube, included, didynamous; fruit dividing at maturity into four one-seeded parts.

Odor and Taste.—Odor heavy, especially if dampened; taste bitter and disagreeable.

Tests for Identity and Purity.—Verbena yields not more than 10 per cent. of ash.

N. F. Preparation.—Fluidextractum Verbenæ.

Uses.—It is a weak antiperiodic. It is used also as an expectorant and diaphoretic in doses of fifteen grains (1 Gm.).

LAPPA. N. F. Lappa

(U. S. P. VIII)

[BURDOCK ROOT]

The dried root of *Arctium Lappa* Linné, or of other species of *Arctium* (Fam. *Compositæ*), collected from plants of the first year's growth.

It contains a bitter substance, inulin, sugar, mucilage, etc.

Official Description.—Nearly simple, fusiform, of variable length, from 5 to 20 mm. in diameter near the crown; frequently split or in broken pieces, externally grayish-brown, longitudinally wrinkled, the crown somewhat annulate, sometimes surmounted by a woolly tuft of leaf remains; fracture somewhat horny; a dark cambium separating the thick brownish bark from the yellowish porous and radiate wood, centrally hollow or containing a white, pith-like tissue.

Odor and Taste.—Odor slight; taste mucilaginous, sweetish, and slightly bitter.

Tests for Identity and Purity.—The powder is light brown and, when examined under the microscope, exhibits parenchyma cells of the cortex; the medullary rays and wood containing amorphous masses or sphero-crystals of inulin; yellow resin cells occur in the cortical parenchyma of young roots; wood-fibers few; no starch and no calcium oxalate. Lappa yields not more than 6 per cent. of ash.

N. F. Preparation.—Fluidextractum Lappæ.

Uses.—It is used as a diuretic and alterative. Dose, thirty grains (2 Gm.).

MENYANTHES. N. F. Menyanthes
[**Menyanth.**—Buckbean Marsh Trefoil]

The dried leaves of *Menyanthes trifoliata* Linné (Fam. *Gentianaceæ*).

The chief constituent is the glucoside *menyanthin*, $C_{30}H_{46}O_{14}$; *meliatin* is also said to be present.

Official Description.—Glabrous; petioles from 10 to 15 cm. in length, stout but soft and weak, the base more or less sheathed with broad, thin, and membranaceous, somewhat translucent stipules; blade ash-green, trifoliate; leaflets sessile or very short-petioled from 5 to 8 cm. in length and usually about two-thirds as broad, obovate, blunt, entire, or occasionally coarsely and unequally crenate.

Odor and Taste.—Odor slight but characteristic; taste decidedly bitter.

Test for Identity and Purity.—Menyanthes yields not more than 10 per cent. of ash.

N. F. Preparation.—Vinum Aurantii Compositum.

Uses.—It is used as a tonic, emmenagogue, and vermifuge. Dose, fifteen grains (1 Gm.).

TRIFOLIUM. N. F. Trifolium
[**Trifol.**—Red Clover Blossoms]

The dried inflorescence of *Trifolium pratense* Linné (Fam. *Leguminosæ*).

It contains *isohamnetin, pratol, pratensol*, and the glucoside *trifolin*, $C_{22}H_{22}O_{11} + H_2O$. None of the ingredients are very active.

Official Description.—Heads ovoid with rounded summit, mostly from 12 to 25 mm. in length and breadth, shriveled, purplish and more or less brown from drying, consisting of many small papilionaceous flowers, crowded together and clothed at the base with broad, pointed ciliate stipules of a pale green color with darker veins, and which may or may not be accompanied by diminutive trifoliate leaves. Flowers from 12 to 15 mm. in length, longer than the four nearly equal teeth and shorter than the narrower fifth tooth; calyx-teeth subulate, tapering; petals united into a tube below, the standard longer than the wings but when, recurved appearing shorter; stamens diadelphous (nine and one); style slender.

Odor and Taste.—Odor faintly aromatic and somewhat tea-like; taste sweetish, then slightly bitter.

Test for Identity and Purity.—Trifolium yields not more than 10 per cent. of ash.

N. F. Preparation.—Fluidextractum Trifolii.

Uses.—It is used as an expectorant and alterative. Dose, one drachm (4 Gm.).

Drugs containing Saponinoid Principles, with their Preparations

SARSAPARILLA. U. S. Sarsaparilla
[**Sarsap.**]

The dried root of *Smilax medica* Chamisso and Schlechtendal, known in commerce as Mexican Sarsaparilla; or *Smilax officinalis* Kunth, or an undetermined species of *Smilax*, known in commerce as Honduras Sarsaparilla; or *Smilax ornata* Hooker filius, known in commerce as Jamaica Sarsaparilla (Fam. *Liliaceæ*).

Mexican Sarsaparilla.—Official Description.—In loose bundles, or pressed into bales, single bundles attaining a length of 60 cm. and composed of from 20 to 35 folded roots attached to a crown with one or more stout stems; roots from 3.5 to 6 mm. in diameter; externally grayish-brown to dark brown, minutely hairy, longitudinally furrowed, the furrows containing more or less of a blackish earth; fracture tough, fibrous; internally light brown with a more of less shrunken, nearly or sometimes horny cortex surrounding the porous central cylinder; pith distinct.

Odor and Taste.—Nearly inodorous; taste mucilaginous, somewhat sweetish and acid. Remove the woody, knotty crown with portions of the overground stems.

Honduras Sarsaparilla.—Official Description.—In more or less compact, cylindrical bundles, attaining a length of 55 cm. and a diameter from 8 to 15 cm., consisting of the long, folded roots bound together by roots of the same plant; roots from 2 to 6 mm. in diameter; externally dark or reddish-brown, longitudinally furrowed, the furrows usually free from soil; fracture fibrous; internally consisting of a grayish-white or dark brown cortex, a light yellow and porous central cylinder and a whitish pith.

Taste.—Taste mucilaginous and slightly acrid.

Jamaica Sarsaparilla.—Official Description.—In more or less compact and somewhat flattened bundles, from 30 to 45 cm. in length and from 10 to 15 cm. in width, consisting of the folded roots loosely bound with roots of the same plant; roots from 2 to 5 mm. in diameter; externally grayish-brown to reddish-brown, longitudinally wrinkled, more or less furrowed and bearing numerous coarse fibrous rootlets.

Taste.—Taste somewhat sweet and slightly bitter.

Tests for Identity and Purity.—Under the microscope, transverse sections of all of the commercial varieties of Sarsaparilla show an epidermal layer with basal portions of root hairs; a hypodermis composed of several layers of strongly lignified cells, the walls being uniformly thickened, except in Mexican Sarsaparilla, in which the inner walls are only slightly thickened; a cortex composed of numerous parenchyma cells mostly containing starch, some containing resin or rhaphides of calcium oxalate; an endodermis of a single layer of strongly lignified cells, the walls being uniformly thickened except in Mexican Sarsaparilla, in which the outer walls are only slightly thickened; a central cylinder composed of radial bundles connected with sclerenchymatous fibers, the tracheæ being large and oval and the phloem in small groups at the periphery of the bundle; and a pith composed of starch-bearing parenchyma cells.

Powdered Sarsaparilla is light grayish-brown to dark grayish-brown; when examined under the microscope it exhibits numerous starch grains, from 0.003 to 0.023 mm. in diameter, spherical, or biconvex or spherical-tetrahedral, single to 2- to 4-compound, and frequently with a central-elliptical cleft; calcium oxalate in rhaphides, from 0.006 to 0.035 mm. in diameter, occurring singly or in groups; cells of the hypodermis and endodermis with lemon-yellow or reddish-yellow porous walls and, in the case of Mexican Sarsaparilla, showing an uneven or irregular thickening, the individual cells from 0.08 to 0.5 mm. in length; fragments of tracheæ with simple and bordered pores to scalariform or reticulate thickenings associated with sclerenchymatous fibers having rather thin, very slightly lignified and porous walls.

Sarsaparilla yields not more than 10 per cent. of ash.

U. S. P. Preparations.—Fluidextractum Sarsaparillæ; Fluidextractum Sarsaparillæ Compositum; Syrupus Sarsaparillæ Compositus (from Fluidextract).

N. F. Preparation.—Decoctum Sarsaparillæ Compositum.

Sarsaparilla contains a glucoside analogous to, if not identical with, saponin, termed *parillin.* When boiled with dilute acids, it splits into *parigenin* and grape sugar. There are also present starch, resin, coloring matter, and extractive. Alcohol and water are good solvents.

Uses.—It is popularly believed to be an alterative. Dose, thirty grains (2 Gm.).

SENEGA. U. S. Senega

[**Seneg.**—SENECA SNAKEROOT SENEGA SNAKEROOT]

The dried roots of *Polygala Senega* Linné (Fam. *Polygalaceæ*), without the presence or admixture of more than 5 per cent. of stems and other foreign matter.

Official Description.—Usually in broken pieces; when entirely slenderly conical, more or less tortuous, somewhat branched, from 3 to 15 cm. in length and from 2 to 10 mm. in thickness and bearing a few rootlets; crown knotty with numerous buds and short stem-bases; externally brownish-yellow, the crown rose-tinted, longitudinally wrinkled, frequently marked by a keel; fracture short, wood pale yellow, usually excentrically developed.

Odor and Taste.—Odor peculiar, penetrating; taste sweetish, afterwards acrid.

Tests for Identity and Purity.—Under the microscope transverse sections of Senega usually show a characteristic excentric development of wood, the central cylinder varying in outline from elliptical or ovate to irregularly fan-shaped, and being surrounded by an unevenly developed cortex which is thickest next to the broadest strands of wood and where the wood-wedges are narrow and the medullary rays very broad, the cortical parenchyma occupies a very narrow zone of the cross-section; in older roots a corky layer of from 4 to 5 rows of tangentially elongated, light yellowish or yellowish-brown cells; outer bark of about 20 rows of cells on one side of the root and only 10 or less on the other, the cells having slightly thickened walls and containing a colorless or pale yellow, amorphous substance, which is liberated in the form of large globules on the addition of a drop of potassium hydroxide T.S.; inner bark, the cells in radial rows, consisting of parenchyma, small groups of sieve tissue and medullary rays, the latter from 1 to 3 cells wide; all the cells in this zone show a collenchymatous thickening of the walls and contain an amorphous substance similar to that found in cells of the outer bark; woody layer of tracheæ with bordered pores, wood-fibers with oblique simple pores, tracheids, and medullary rays, the latter being rather indistinct and resembling the wood-fibers; tissues of the central layer of wood colored yellowish- or reddish-brown on the addition of a drop of potassium hydroxide T.S.

The powder is yellowish-gray to light yellowish-brown, odor penetrating, slightly sternutatory; when examined under the microscope it exhibits a mixture of fragments of parenchyma containing oily globules and wood-fibers with tracheæ; wood-fibers, non-lignified and with oblique simple pores, from 0.175 to 0.25 mm. in length; tracheæ with simple and bordered pores and about 0.175 mm. in length; medullary ray cells somewhat lignified and with large simple pores.

Extract 10 Gm. of powdered Senega by means of a Soxhlet apparatus, using 50 mils of ether containing 2 drops of hydrochloric acid. Continue the extraction during four or five hours and then add sufficient ether to make the liquid measure 50 mils. Take 25 mils of this solution and evaporate it on a water bath to dryness; the residue weighs not less than 0.3 Gm., and upon dissolving it in 10 mils of chloroform, transferring the solution to a test tube and adding 5 mils of sulphuric acid to form an underlying layer, a reddish-brown color is produced at the zone of contact, and the sulphuric acid shows a slightly green fluorescence after the mixture has stood for twenty-four hours. Pour 10 mils of the original ethereal solution into a beaker containing 10 mils of water and warm the mixture on a water bath until the ether has evaporated; the aqueous solution, on filtering and adding a few drops of ferric chloride T.S., becomes a bright pinkish purple.

Senega yields not more than 5 per cent. of ash.

U. S. P. Preparations.—Fluidextractum Senegæ; Syrupus Senegæ (from Fluidextract); Syrupus Scillæ Compositus (from Fluidextract).

N. F. Preparations.—Mistura Pectoralis, Stokes (from Fluidextract); Syrupus Cimicifugæ Compositus (from Fluidextract).

Senega contains *senegin*, $C_{32}H_{54}O_{18}$, *polygalic acid*, fixed oil, pectose, etc. *Senegin* is analogous to, if not identical with, saponin. Alcohol and water are good menstrua for extracting its virtues. Liquid preparations of senega are very apt to gelatinize, owing to the presence of pectin; this is obviated by using solution of potassium hydroxide or other alkali to dissolve it.

Uses.—Senega is a valuable expectorant and stimulant. **Dose,** fifteen grains (1 Gm.).

QUILLAJA. N. F. Quillaja

(U.S.P. VIII)

[Soap-tree Bark]

The dried bark of *Quillaja Saponaria* Molina (Fam. *Rosaceæ*), deprived of the periderm.

This South American bark owes its activity to a peculiar principle, *saponin*, $C_{32}H_{54}O_{18}$, a glucoside, splitting upon heating with dilute acid into *sapogenin* and sugar. Saponin is a sternutatory, white powder, soluble in alcohol and hot water; its aqueous solution froths when agitated, like soapsuds; it is found in several other drugs. Quillaja also contains calcium oxalate and calcium sulphate.

Official Description.—In flat pieces of variable lengths, from 3 to 8 mm. in thickness, or in small chips; outer surface brownish-white, often with small patches of cork attached, otherwise nearly smooth; inner surface yellowish-white, nearly smooth, with occasional circular depressions, conical projections of transverse channels; fracture uneven and strongly fibrous, the laminæ oblique to each other.

Odor and Taste.—Odor slight; taste acrid.

The powder is strongly sternutatory, and contains calcium oxalate in monoclinic pyramids and prisms from 0.035 to 0.2 mm. in length.

Tests for Identity and Purity.—Quillaja yields not more than 10 per cent. of ash.

N. F. Preparations.—Liquor Picis Carbonis; Tinctura Quillajæ.

Uses.—It is used principally for cleansing silk; in pharmacy it is used as an emulsifying agent, but, as saponin is not an inert substance, it is unfitted for this purpose. It is sometimes used in medicine, and is irritant, diuretic, and stimulating. Dose, three grains (0.2 Gm.).

Unofficial Drugs containing Glucosides or Bitter Principles

Azedarach Azedarach	The bark of the root of *Melia Azadirachta.* It contains a resinous principle, and is used as an emetic and anthelmintic, in doses of fifteen to thirty grains (1 to 2 Gm.)
Cassia Marilandica American Senna	Cathartic. Used in the form of infusion
Chamælirium Starwort	The rhizome of *C. luteum* and other species. It contains about 8 per cent. of the glucoside *chamælirin*
Coronilla Scorpioides	Cardiac stimulant, diuretic
Frasera American Columbo	The root of *F. Walteri,* indigenous to the United States. It contains *gentisic acid* and *gentiopicrin*
Gillenia Gillenia	The rhizome of *G. trifoliata* and others, indigenous to the United States. It contains the bitter principle *gillenin,* resin, tannin, etc.
Gratiola Hedge Hyssop	From *G. officinalis,* indigenous to Southern Europe. It contains a bitter glucoside, *gratiolin,* etc.
Hedera Helix Ivy	Contains a glucoside, and hederic and tannic acids. Dose, twenty grains (1.3 Gm.) or more, dried and powdered, given in the atrophy of children
Helleborus Black Hellebore	The rhizome of *H. niger,* grown in Europe. It contains a crystalline glucoside, *helleborin,* $C_{26}H_{44}O_{15}$
Ilex Holly	The leaves of different species of *Ilex,* indigenous to the United States. It contains *ilixanthin,* $C_{17}H_{22}O_{11}$, and *ilicic acid*
Ledum Marsh Tea	The leaves of *L. palustre,* grown in North America. It contains the glucoside *ericolin,* $C_{34}H_{56}O_{21}$; also about 1 per cent. of volatile oil
Ligustrum Privet	The leaves of *L. vulgare,* indigenous to Southern Europe. It contains *ligustrin,* etc.
Liriodendron Tulip Tree Bark	The bark of *L. tulipifera,* found in the Northern United States. It contains *liriodendrin,* which occurs in white prisms
Lupinus Albus Lupin	Contains a glucoside, *lupinin,* $C_{29}H_{32}O_{16}$. The seeds are used as an anthelmintic, diuretic, and emmenagogue
Megarrhiza Californica (Man Root)	It contains a resinous substance called *megarrhizitin,* and a glucoside called *megarrhin,* possessing mydriatic properties
Panax Ginseng	The root of *P. quinquefolium,* found in North America. It contains *panaquilon,* $C_{12}H_{25}O_9$
Picrotoxinum, $C_{30}H_{34}O_{13}$ Picrotoxin. U. S. P. 1890	A neutral principle obtained from the seed of *Anamirta paniculata* Colebrook (Fam. *Menispermaceæ*). Odorless, bitter, colorless crystals, or a micro-crystalline powder, used as a tonic and antispasmodic, in doses of one-sixtieth grain (0.001 Gm.). Very poisonous in large doses
Piscidia Erythrina Jamaica Dogwood	Narcotic, anodyne. Dose of fluidextract is a fluidrachm (4 mils), to be increased carefully
Prinos Black Alder	The bark of *Prinos verticillatus.* It contains a bitter principle. It is a tonic, astringent, and alterative
Rhus Toxicodendron Poison Ivy. U. S. P. 1890	The fresh leaves of *Rhus radicans* Linné. Fam. *Anacardiaceæ.* It contains *toxicodendric acid,* fixed oil, etc. It is toxic, irritant, and rubefacient. Dose, five grains (0.32 Gm.)
Ruta Rue	The leaves of *R. graveolens,* which grows in Southern Europe. It contains a volatile oil and *rutin,* $C_{25}H_{28}O_{15}$, which occurs in needle-shaped crystals. Emmenagogue. Dose, fifteen to thirty grains (1 to 2 Gm.), two or three times a day, preferably given in infusion
Sabbatia American Centaury	A simple bitter. Dose, a drachm (4 Gm.), given in the form of fluid extract or decoction
Salix Willow	The bark of *Salix alba,* and of other species of Salix. It contains a glucoside, *salicin* ($C_{13}H_{18}O_7$)
Saponaria Officinalis Soapwort Bouncing Bet	Contains a glucoside, saponin
Simaruba Simaruba	The bark of the root of *S. officinalis,* grown in South America. It contains a bitter principle, a volatile oil, etc. Tonic. Dose, from twenty to sixty grains (1.3 to 4 Gm.), best given in infusion
Taxus Yew	From *Taxus baccata,* grown in Asia. It contains volatile oil, *taxina,* etc.
Ustilago Corn Smut	From *Zea Mays.* It contains a principle analogous to sclerotic acid. Used as a parturient. Dose, fifteen to thirty grains (1 to 2 Gm.)
Viola Tricolor Pansy	The flowering herb of *Viola tricolor.* It contains a bitter principle, salicylic acid, etc. It is expectorant and alterative, in doses of fifteen to forty grains (1 to 2.6 Gm.)

Drugs containing Cathartic Principles, and their Preparations

SENNA. U. S. Senna

[Senn.]

The dried leaflets of *Cassia acutifolia* Delile, known in commerce as Alexandria Senna, or of *Cassia angustifolia* Vahl, known in commerce as India Senna (Fam. *Leguminosæ*), without the presence or admixture of more than 10 per cent. of stem tissues, pods, seeds, and other impurities.

Alexandria Senna.—Official Description.—Usually unbroken, occasionally in fragments, leaflets inequilaterally lanceolate or lance-ovate, from 2 to 3.5 cm in length and from 6 to 10 mm. in breadth, having extremely short stout petiolules; acutely cuspidate, entire, subcoriaceous, brittle, pale green or grayish-green, sparsely and obscurely hairy, especially beneath the hairs appressed.

Test for Identity.—Pods few, broadly elliptical, somewhat reniform—dark green, thin and membranous.

India Senna.—Official Description.—Leaflets usually unbroken, from 2 to 5 cm. in length and from 6 to 14 mm. in breadth, usually more abruptly pointed than those of Alexandria Senna, yellowish-green and smooth above, paler beneath.

Odor and Taste.—Odor and taste closely resembling Alexandria Senna.

Tests for Identity and Purity.—Pods few, elliptical, more or less reniform and from 4 to 5 cm. in length.

Powdered Alexandria Senna is light green; when examined under the microscope it exhibits non-glandular hairs, 1-celled, conical, often curved, from 0.1 to 0.35 mm. in length, walls thick and papillose; calcium oxalate in rosette aggregates, from 0.009 to 0.01 mm. in diameter, and in 4- to 6-sided prisms, about 0.015 mm. in length, usually in crystal fibers; stomata broadly elliptical, about 0.02 mm. in long diameter. In India Senna the powder is slightly darker green than that of Alexandria Senna and the hairs are similar but relatively fewer.

Mix 0.5 Gm. of powdered Senna with 10 mils of an alcoholic solution of potassium hydroxide (1 in 10), boil the mixture for about two minutes, dilute it with 10 mils of water and filter. Now acidify the filtrate with hydrochloric acid, shake it with ether; remove the ethereal layer and shake it with 5 mils of ammonia water; the latter is colored pinkish-red or bluish-red.

Senna yields not more than 12 per cent. of ash. The yield of ash insoluble in hydrochloric acid is not more than 3 per cent. of the Senna taken.

U. S. P. Preparations.—Fluidextractum Sennæ; Infusum Sennæ Compositum; Pulvis Glycyrrhizæ Compositus; Syrupus Sarsaparillæ Compositus (from Fluidextract); Syrupus Sennæ (from Fluidextract).

N. F. Preparations.—Confectio Sennæ; Elixir Cascaræ Sagradæ Compositum (from Fluidextract); Elixir Catharticæ Compositum (from Fluidextract); Species Laxativæ; Syrupus Ficorum Compositus; Syrupus Sennæ Aromaticus; Syrupus Sennæ Compositus.

Senna, according to Tschirch, contains *anthroglucosennin, emodin, chrysophanic acid,* isoemodin, glucosennin, sennanigrin, and sennarhamnetin. Emodin and chrysophanic acids are oxymethylanthraquinones upon which the cathartic action is believed to depend. *Cathartic acid* was formerly believed to be the chief purgative principle. When senna leaves are macerated in strong alcohol, the principles which produce griping and give odor and taste are dissolved, while the purgative properties are unaffected. Water and diluted alcohol are good solvents for its virtues. It is an important ingredient in the compound powder of glycyrrhiza.

Uses.—Senna is purgative and cathartic. The dose is one to four drachms (4 to 16 Gm.), when given in infusion.

RHEUM. U. S. Rhubarb

The rhizomes and roots of *Rheum officinale* Baillon, *Rheum palmatum* Linné, and the var. *tanguticum* Maximowicz (Fam. *Polygonaceæ*), and probably other species of *Rheum* grown in China and Thibet, deprived of most of the bark tissues and carefully dried. Preserve Rhubarb in tightly-closed containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects.

Official Description.—In sub-cyindrical, barrel-shaped, or conical pieces known in commerce as "rounds," or in plano-convex pieces known in commerce as "flats," or in irregularly formed pieces, frequently with perforations. It is hard and moderately heavy, attaining a length of 17 cm. and a diameter of 10 cm., often cut in pieces of variable form and size; outer surfaces yellowish-brown, mottled, with alternating, longitudinal striæ of grayish-white parenchyma and reddish or brownish medullary rays; small stellate groups of fibro-vascular tissue and occasionally reddish-brown cork patches, smooth and sometimes covered with a bright, brownish-yellow powder; fracture uneven and granular, presenting a characteristic mottled appearance.

Odor and Taste.—Odor aromatic, characteristic; taste characteristic, slightly bitter and astringent, gritty when chewed and tingeing the saliva yellow.

Tests for Identity and Purity.—Under the microscope, sections of Rhubarb show numerous thin-walled parenchymatous cells containing either a large number of starch grains or a single large rosette aggregate of calcium oxalate; scattered among the parenchyma are stellate groups of compound fibro-vascular bundles, the latter composed of narrow medullary rays separating the wedges, having large tracheæ in the outer part and separated by a prominent cambium from an internal phloem or sieve; among the grayish-white parenchyma of the inner bark occur narrow, yellowish-brown, irregular medullary rays.

Not more than 15 per cent. of the drug should show a hollow or dark central area.

The powder is bright orange-yellow to yellowish-brown; becoming red with alkalies; when examined under the microscope it exhibits calcium oxalate in rosette aggregates, mostly from 0.05 to 0.1 mm. in diameter, occasionally attaining a diameter of 0.15 mm.; starch grains numerous, somewhat spherical, single or 2- to 4-compound, each with a single cleft, from 0.002 to 0.02 mm. in diameter; tracheal fragments few, mostly reticulate, occasionally spiral.

Boil 0.1 Gm. of powdered Rhubarb with 10 mils of an aqueous solution of potassium hydroxide (1 in 100); allow it to cool, filter, acidulate the filtrate with hydrochloric acid and shake it with 10 mils of ether; on standing, the ethereal layer is colored yellow. Shake this ethereal solution with 5 mils of ammonia water; the latter is colored cherry-red (presence of *emodin*) and the ethereal layer remains yellow (presence of *chrysophanic acid*).

Rhubarb, when exhausted with diluted alcohol, yields not less than 30 per cent. of dry extract.

Rhubarb yields not more than 13 per cent. of ash.

U. S. P. Preparations.—Extractum Rhei; Fluidextractum Rhei; Pilulæ Rhei Compositæ; Pulvis Rhei Compositus; Syrupus Rhei (from Fluidextract); Syrupus Rhei Aromaticus (from Aromatic Tincture); Tinctura Rhei; Tinctura Rhei Aromatica.

N. F. Preparations.—Elixir Catharticum Compositum (from Fluidextract); Fluidglyceratum Rhei; Mistura Opii et Rhei Composita (from Tincture); Mistura Rhei Alkalina (from Fluidextract); Mistura Rhei Composita (from Fluidextract); Pilulæ Antiperiodicæ; Pilulæ Antiperiodicæ sine Aloe; Pilulæ Rhei; Pulvis Rhei et Magnesiæ Anisatus; Syrupus Sennæ Aromaticus; Syrupus Sennæ Compositus (from Fluidextract); Tinctura Antiperiodica; Tinctura Antiperiodica sine Aloe; Tinctura Rhei Aquosa; Tinctura Rhei Dulcis; Tinctura Rhei et Gentianæ; Tinctura Zedoariæ Amara; Vinum Rhei Compositum (from Fluidextract).

Rhubarb contains *chrysophanic acid,* or dioxymethylanthraquinone, $C_{15}H_8O_2(OH)_2$; *emodin,* or trioxymethylanthraquinone, $C_{15}H_7O_2(OH)_3$; *rhein,* or tetraoxymethylanthraquinone, $C_{15}H_{10}O_6$; *rhabarberon,* $C_{15}H_{10}O_5$; and the resins, *erythroretin, phæoretin,* and *aporetin.* The astringent properties of rhubarb are due to *rheotannic acid,* $C_{26}H_{26}O_{14}$; calcium oxalate is also present.

Uses.—The therapeutical properties of rhubarb depend upon the valuable natural combination of its cathartic and astringent constituents. It is given in doses of ten to twenty grains (0.65 to 1.3 Gm.).

CHRYSAROBINUM. U. S. Chrysarobin
[Chrysarob.]

A mixture of neutral principles extracted from Goa powder, a substance found deposited in the wood of *Vouacapoua Araroba* (Aguiar) Druce (Fam. *Leguminosæ*). Preserve it in well-closed containers, protected from light.

Official Description.—A brownish to orange-yellow, micro-crystalline powder.

Odor and Taste.—Tasteless, odorless, and irritating to the mucous membrane.

Solubility.—One Gm. of Chrysarobin dissolves in 385 mils of alcohol, 12.5 mils of chloroform, 16 mils of ether, 30 mils of benzene and in 180 mils of carbon disulphide at 25° C. (77° F.), very slightly soluble in water, and in boiling water; it dissolves in solutions of the fixed alkali hydroxides, producing a red liquid.

Tests for Identity and Purity.—It dissolves in sulphuric acid, producing a deep red solution. On pouring this liquid into water, Chrysarobin is deposited unchanged.

Incinerate about 0.5 Gm. of Chrysarobin; not more than 0.25 per cent. of ash remains.

Mix about 0.001 Gm. of Chrysarobin with 2 drops of fuming nitric acid; a red mixture is produced, which turns violet-red on the addition of a few drops of ammonia water (distinction from *chrysophanic acid,* which produces a yellow liquid).

Chrysophanic Acid.—Boil about 0.1 Gm. of Chrysarobin with 20 mils of distilled water and filter; the filtrate is neutral to litmus and is not changed in color by a few drops of ferric chloride T.S.

U. S. P. Preparation.—Unguentum Chrysarobini.

Uses.—Chrysarobin has been largely used in certain skin diseases, notably psoriasis. It has fallen into disuse mainly on account of the almost indelible stain produced upon the skin and clothing when it is employed. Internally, chrysarobin is cathartic, in the dose of one-half grain (0.032 Gm.).

CAMBOGIA. U. S. Gamboge
[Cambog.—Pipe Gamboge]

A gum-resin obtained from *Garcinia Hanburii* Hooker filius (Fam. *Guttiferæ*).

Official Description.—In hard, brittle, cylindrical pieces, usually hollow in the center, from 2 to 5 cm. in diameter, from 10 to 20 cm. in length, externally grayish-orange-brown, longitudinally striate; fracture conchoidal, smooth, orange-red.

Odor and Taste.—Odorless; taste very acrid.

Tests for Identity and Purity.—When rubbed with water it yields a yellow emulsion which becomes darker and almost transparent upon the addition of ammonia water. The emulsion turns green upon the addition of iodine T.S. (*starch*).

The powder is bright yellow, containing few or no starch grains. When mounted in hydrated chloral T.S. and examined under the microscope, the particles, for the most part, slowly dissolve, leaving scattered fragments of vegetable tissues.

Not less than 65 per cent. of Gamboge is soluble in alcohol.

Gamboge yields not more than 2 per cent. of ash.

U. S. P. Preparation.—Pilulæ Catharticæ Compositæ.

Gamboge contains about 75 per cent. of resin called *gambogic acid,* which is dissolved by alkaline solutions, producing a red color; 20 per cent. of gum is present, and this enables gamboge to be emulsified like the other gum resins.

Uses.—It is a powerful hydragogue cathartic, and is generally used in combination with other substances, which modify its action. Dose, one-half to three grains (0.03 to 0.2 Gm.).

JALAPA. U. S. Jalap
[Jalap.]

The dried tuberous root of *Exogonium Purga* (Wenderoth) Bentham (Fam. *Convolvulaceæ*), yielding not less than 7 per cent. of the total resins of Jalap.

Official Description.—Fusiform, irregularly ovoid or pyriform, upper end more or less rounded, lower end slightly tapering, the large roots often incised or cut into pieces; from 4 to 15 cm. in length and from 12 to 60 mm. in diameter; externally dark brown, longitudinally wrinkled or furrowed and with numerous lenticels; hard, compact, not fibrous; when broken, internally dark brown, mealy or waxy, bark from 1 to 2 mm. in thickness, outer bundles separated from the outer cortical layer by a distinct, brown cambium zone.

Odor and Taste.—Odor slight but distinctive, smoky; taste somewhat sweet and acrid.

Tests for Identity and Purity.—The powder is light brown; starch grains numerous, single or 2- to 3-compound, and more or less swollen, ellipsoidal or ovoid with concentric or excentral lamellæ and radiating clefts or fissures, from 0.003 to 0.035 mm. in diameter; calcium oxalate in rosette aggregates from 0.01 to 0.035 mm. in diameter; tracheæ short, wide, with simple or bordered pores; lacticiferous vessels with yellowish-brown, resinous masses.

Jalap yields not more than 6.5 per cent. of ash.

Assay.—Pack 10 Gm. of Jalap, in No. 60 powder, in a cylindrical percolator and extract it with alcohol until the percolate measures 100 mils. Transfer 20 mils of the percolate to a separator, add 20 mils of chloroform, mix the liquids, then add 20 mils of distilled water and shake the mixture thoroughly. When the liquids have completely separated, draw off the chloroform into a tared beaker, wash the contents of the separator by rotating with 5 mils of chloroform and draw it off into the beaker. Evaporate the chloroform solution on a water bath, add about 2 mils of alcohol, again evaporate, and then dry the residue to constant weight at 100° C. (212°F.). The weight will be the amount of total resins from 2 Gm. of Jalap.

U. S. P. Preparations.—Pulvis Jalapæ Compositus; Resina Jalapæ.

N. F. Preparations.—Extractum Jalapæ; Fluidextractum Jalapæ, Pilulæ ad Prandium (Cole's); Pilulæ Catharticæ Vegetabiles (from Resin); Pulvis Hydrargyri Chloridi Mitis et Jalapæ; Syrupus Sennæ Aromaticus; Tinctura Jalapæ; Tinctura Jalapæ Compositæ.

Jalap contains from 8 to 16 per cent. of resin, the greater part of which is *convolvulin*, or *jalapurgin*, $C_{62}H_{100}O_{32}$, a glucoside insoluble in ether; there are also present gum, sugar, starch, etc. The value of jalap depends exclusively upon the amount of convolvulin present, and the U. S. Pharmacopœia gives an assay for the resins.

Uses.—Jalap is an esteemed cathartic, and is generally used in combination with substances having similar properties. Dose, ten to twenty grains (0.65 to 1.3 Gm.).

SCAMMONIÆ RADIX. U. S. Scammony Root
[Scam. Rad.]

The dried root of *Convolvulus Scammonia* Linné (Fam. *Convolvulaceæ*), yielding not less than 8 per cent. of the total resins of Scammony Root.

Official Description.—Cylindrical or somewhat tapering, from 10 to 25 cm. in length and from 1 to 4.5 cm. in thickness; externally grayish- to reddish-brown; usually distinctly twisted, deeply longitudinally furrowed, marked by distinct root-scars, otherwise nearly smooth except for the lenticels and abraded cork, the upper portion terminated usually by a number of short stem branches; hard and heavy; fracture tough, irregular with projecting wood-fibers; internally somewhat mottled, showing yellowish; porous wood-wedges separated by whitish parenchyma containing starch and resin; bark thin.

Odor and Taste.—Odor slight, resembling that of jalap; taste very slightly sweet, becoming slightly acrid.

Tests for Identity and Purity.—Under the microscope, sections of Scammony Root show a corky layer consisting of from 2 to 10 rows of cells, with thin, yellowish-brown, lignified walls; an outer cortex with numerous stone cells occurring singly or in small groups, the walls being moderately thick, porous and not strongly lignified; parenchyma with numerous starch grains and monoclinic prisms of calcium oxalate; fibro-vascular bundles numerous, circular or elliptical with a well-developed wood consisting of large tracheæ surrounded by slightly lignified wood-fibers; phloem or sieve prominent in which are included large resin ducts; the parenchyma, both in and surrounding the bundles, more or less collapsed and containing either starch or calcium oxalate crystals.

The powder is light grayish-brown; when examined under the microscope it exhibits starch grains from 0.003 to 0.018 mm. in diameter, mostly single, occasionally 2- to 4-compound, the grains showing occasionally a central cleft; calcium oxalate crystals numerous, in monoclinic prisms from 0.01 to 0.045 mm. in length; fragments of leptomes or sieve with accompanying yellowish-brown resin cells; tracheæ mostly with reticulate thickenings and simple or bordered pores and associated with short wood-fibers having prominent oblique pores; stone cells of variable shape and varying from 0.04 to 0.11 mm. in length, the walls being from 0.006 to 0.012 mm. in thickness, slightly lignified and traversed with prominent, often branching pores; lignified cork cells relatively few.

Assay.—Proceed as directed under *Jalapa,* using 10 Gm. of Scammony Root in No. 60 powder.

U. S. P. Preparations.—Extractum Colocynthidis Compositum (from Resin); Resina Scammoniæ.

N. F. Preparations.—Pilulæ Aloes, Hydrargyri et Scammonii Composita (from Resin); Pilulæ Colocynthidis Compositæ (from Resin); Pilulæ Colocynthidis et Hyoscyami (from Resin); Tinctura Jalapæ Composita (from Resin).

Scammony root contains from 8 to 9 per cent. of a resin having cathartic properties, called *scammonin,* or *orizabin,* $C_{34}H_{56}O_{16}$; this is identical with the jalapin obtained from *Ipomœa orizabensis* (see *U. S. Dispensatory,* 20th edition).

Uses.—Scammony is a hydragogue cathartic; it is usually combined with other purgatives. Dose, four to ten grains (0.25 to 0.65 Gm.).

PODOPHYLLUM. U. S. **Podophyllum**

[**Podoph.**—Mandrake May Apple Rhizome]

The dried rhizome and roots of *Podophyllum peltatum* Linné (Fam. *Berberidaceæ*), yielding not less than 3 per cent. of resin.

Official Description.—Rhizome horizontal, nearly cylindrical, jointed, compressed on the upper and lower surfaces, sometimes branched; in pieces from 3 to 20 cm. in length, the internodes from 2 to 9 mm. in diameter; externally dark brown, longitudinally, wrinkled or nearly smooth with irregular, somewhat V-shaped scars of scale leaves, nodes annulate, upper portion marked with large, circular, depressed stem-scars and sometimes with buds or stem-bases; at or near the nodes on the lower portion occur numerous root-scars or roots from 2 to 7 cm. in length and about 2 mm. in thickness; fracture short; internally, bark light brown, wood with small yellowish, vascular bundles, pith large and white.

Odor and Taste.—Odor slight; taste sweetish, disagreeably bitter and acrid.

Tests for Identity and Purity.—Under the microscope, a transverse section of the rhizome of Podophyllum shows an outer layer of one or two rows of reddish-brown cells; parenchyma of cortex and pith with numerous single, spherical, polygonal, or 2- to 6-compound starch grains, or rosette aggregates of calcium oxalate; vascular bundles from 24 to 34, arranged in a circle between cortex and pith.

The powder is light brown, with a pronounced and characteristic odor; starch grains numerous, spherical, polygonal or 2- to 6-compound, the individual grains from 0.003 to 0.015 mm. in diameter; calcium oxalate crystals few, in rosette aggregates from 0.05 to 0.08 mm. in diameter and occasionally in rhaphides from 0.03 to 0.09 mm. in length; tracheæ with simple pores or reticulate thickenings; fragments of starch-bearing parenchyma and reddish-brown cork cells.

Podophyllum yields not more than 3 per cent. of ash.

Assay.—Proceed as directed for the preparation of *Resina Podophylli* (see page 644), using 10 Gm. of Podophyllum in No. 60 powder. It shows not less than 3 per cent. of resin.

U. S. P. Preparations.—Fluidextractum Podophylli; Resina Podophylli.

N. F. Preparations.—Extractum Podophylli; Pilulæ Aloes et Podophylli Compositæ (from Resin); Pilulæ Aloes, Hydrargyri et Podophylli (from Resin); Pilulæ

Aloini Compositæ (from Resin); Pilulæ Catharticæ Vegetabiles (from Resin); Pilulæ Colocynthidis et Podophylli (from Resin); Pilulæ Laxativæ Post Partum (from Resin).

Podophyllum contains *picropodophyllin*, *podophyllotoxin*, and *podophyllinic acid.* The resinous substances extracted from the powdered rhizome with alcohol contain the purgative principles.

Uses.—It is cholagogue and cathartic, in doses of eight to twenty grains (0.5 to 1.3 Gm.).

CASCARA SAGRADA. U. S. Cascara Sagrada

[**Casc. Sagr.**—Rhamnus Purshiana, U. S. P. VIII]

The dried bark of the trunk and branches of *Rhamnus Purshiana* De Candolle (Fam. *Rhamnaceæ*).

Official Description.—Usually in flattened or transversely curved pieces, occasionally in quills; bark from 1 to 5 mm. in thickness; outer surface dark brown or brownish red, longitudinally ridged, often nearly covered with grayish or whitish lichens, bearing small blackish apothecia, sometimes with numerous lenticels, and occasionally with mosses; inner surface light yellow, light brown, or reddish-brown, longitudinally striate, turning red when moistened with solutions of the alkalies; fracture short, with projections of bast-fibers in the inner bark; in cross-section inner bark shows diagonal or curved medullary rays forming converging groups, the outer bark showing yellowish groups of stone cells which are especially apparent on moistening the freshly cut surface with phloroglucinol T.S. and hydrochloric acid.

Odor and Taste.—Odor distinct; taste disagreeable, bitter, and slightly acrid.

Tests for Identity and Purity.—Under the microscope, a transverse section of Cascara Sagrada shows an outer yellowish-brown or reddish-brown corky layer consisting of 10 to 15 or more rows of cells; stone cells in outer bark in tangentially elongated groups of 20 to 50 cells, the walls being very thick and finely lamellated; medullary rays 1 to 4 cells wide, 15 to 25 cells deep, the contents being colored red upon the addition of solutions of the alkalies to the sections; bast-fibers in tangentially elongated groups in the inner bark, the walls being thick and strongly lignified; crystal fibers around the bast-fibers with individual crystals from 0.008 to 0.015 mm. in length; parenchyma with spheroidal starch grains about 0.003 to 0.008 mm. in diameter, or with calcium oxalate either in rosette aggregates or prisms from 0.01 to 0.02 mm. in diameter.

Add 0.1 Gm. of powdered Cascara Sagrada to 10 mils of hot water, shake the mixture occasionally until cold, filter it and add sufficient water to make 10 mils; on the addition of 10 mils of ammonia water to this liquid, it is colored an orange yellow.

Macerate 0.1 Gm. of powdered Cascara Sagrada with 10 drops of alcohol, boil the mixture with 10 mils of water, when cold filter it and shake the filtrate with 10 mils of ether; a yellow ethereal solution separates. Shake 3 mils of this ethereal solution with 3 mils of ammonia water; the separated ammoniacal solution still possesses, on diluting with 20 mils of water, a distinct, yellowish-red color.

The powder is light brown to olive brown, showing characteristic elongated groups of bast-fibers associated with crystal fibers, the crystals in the latter being in the form of monoclinic prisms from 0.008 to 0.015 mm. in length; stone cells in large groups, the cells having thick and finely porous walls; fragments of parenchyma and medullary ray cells colored red upon the addition of solutions of the alkalies; starch grains either free or in parenchyma cells, the individual grains being somewhat spheroidal, from 0.003 to 0.008 mm. in diameter; calcium oxalate in monoclinic prisms or rosette aggregates from 0.01 to 0.02 mm. in diameter; occasional fragments of reddish-brown cork.

U. S. P. Preparations.—Extractum Cascaræ Sagradæ; Fluidextractum Cascaræ Sagradæ; Fluidextractum Cascaræ Sagradæ Aromaticum.

N. F. Preparations.—Elixir Cascaræ Sagradæ (from Aromatic Fluidextract); Elixir Cascaræ Sagradæ Compositum (from Aromatic Fluidextract); Fluidglyceratum Cascaræ Sagradæ; Fluidglyceratum Cascaræ Sagradæ Aromaticum; Pilulæ Aloini, Strychninæ et Belladonnæ Compositæ (from Extract); Syrupus Ficorum Compositus (from Aromatic Fluidglycerate).

This bark contains a neutral, crystallizable principle, *purshianin* or *cascarin*, also *rhamnetin*, *emodin*, and *chrysophanic acid*, resins, and tannic, malic, and oxalic acids.

Uses.—It is a laxative. Dose, fifteen grains (1 Gm.).

FRANGULA. U. S. Frangula

[Frang.—Buckthorn Bark]

The dried bark of *Rhamnus Frangula* Linné (Fam. *Rhamnaceæ*).

Official Description.—In quills varying in length, frequently flattened or crushed; from 0.5 to 1 mm. in thickness; outer surface grayish-brown or purplish-black, with numerous prominent, lighter-colored, transverse lenticels and occasional patches of foliaceous lichens bearing small, blackish apothecia; inner surface smooth, dark brown with occasional purplish blotches, longitudinally striate, becoming red when moistened with solutions of the alkalies; fracture short, slightly fibrous in the inner layer.

Odor and Taste.—Odor distinctive; taste slightly bitter.

Tests for Identity and Purity.—Under the microscope, transverse sections of Frangula show a distinctly undulate corky layer, composed of about 12 rows of reddish-brown cells; parenchyma cells of the primary cortex with numerous rosette aggregates of calcium oxalate, from 0.01 to 0.025 mm. in diameter; inner bark with bast-fibers in narrow, interrupted rows, the groups of fibers being separated radially by the medullary rays; bast-fibers with thick, strongly lignified, yellowish walls and narrow lamina and each group surrounded by a layer of crystal fibers, the prismatic crystals of calcium oxalate varying from 0.007 to 0.015 mm. in diameter, medullary rays one to two cells in width, occasionally three; cells of the parenchyma and medullary rays with numerous starch grains, 0.003 mm. in diameter.

The powder is yellowish-brown; stone cells absent (distinguishing it from the powder of *Cascara Sagrada*).

Add 0.1 Gm. of powdered Frangula to 10 mils of hot distilled water, shake the mixture occasionally until cold and filter; on the addition of a few drops of ammonia water, the filtrate is colored a deep red.

Macerate 0.1 Gm. of powdered Frangula with 10 drops of alcohol, boil with 10 mils of distilled water and filter when cold. Shake this filtrate with 10 mils of ether; a yellow ethereal solution separates, and 3 mils of this ethereal solution, when shaken with 3 mils of ammonia water, yields an alkaline solution, which, on being diluted with 20 mils of distilled water, still possesses a distinct cherry-red color.

Frangula yields not more than 6 per cent. of ash.

U. S. P. Preparation.—Fluidextractum Frangulæ.

N. F. Preparations.—Elixir Catharticum Compositum (from Fluidextract); Syrupus Sennæ Compositus (from Fluidextract).

This bark contains *frangulin*, $C_{20}H_{20}O_9$, emodin, *frangulic acid*, isoemodin, tannin, resin, and other constituents.

Uses.—When frangula is fresh, it is emetic; when old, it is purgative, tonic, and diuretic. The dose is fifteen grains (1 Gm.).

ALOE. U. S. Aloes

The inspissated juice of the leaves of *Aloe Perryi* Baker, yielding Socotrine Aloes; or *Aloe vera* Linné, yielding Curaçao Aloes; or of *Aloe ferox* Miller, yielding Cape Aloes (Fam. *Liliaceæ*).

Aloes contains *aloin*, *emodin*, a trace of volatile oil, and a substance which has been improperly called resin. The aloin present in Socotrine aloes is *socaloin*, $C_{15}H_{16}O_7$. This may be distinguished from nataloin and barbaloin by Histed's test, as follows: barbaloin and nataloin are colored bright red by nitric acid; socaloin is not colored red. If nataloin is added to a drop of sulphuric acid on a white porcelain plate and a rod dipped in nitric acid passed over it, the color changes to blue; with the other aloins no blue color is produced. According to Tschirch, emodin is present in aloes and aloin. A similar principle is also found in other cathartic drugs, senna, rhubarb, rhamnus, etc. He explains the cathartic action by the fact that the alkaline secretions of the upper intestines decompose and set free the emodin (trioxymethylanthraquinone), which produces peristalsis and the cathartic action follows. The formerly official *Purified Aloes* is no longer required, as the commercial aloes of the present day is highly purified and practically identical.

Socotrine Aloes.—Official Description.—In yellowish-brown to blackish-brown opaque, or smooth and glistening masses; fractured surface somewhat conchoidal; sometimes soft or semi-liquid.

Odor and Taste.—Odor aromatic or saffron-like, never fetid or putrid; taste nauseous, bitter.

Tests for Identity and Purity.—Not less than 50 per cent. of Socotrine Aloes is soluble in cold water, the solution being of a yellowish color.

The powder is dark brown; when mounted in expressed oil of almond and examined under the microscope, it shows yellowish- to reddish-brown, irregular or angular fragments. Upon the addition of nitric acid, it yields a yellowish- to reddish-brown solution.

Curacao Aloes.—Official Description.—In orange to blackish-brown, opaque masses; fractured surface uneven, waxy, somewhat resinous.

Odor and Taste.—Odor characteristic but not aromatic as in Socotrine Aloes.

Tests for Identity and Purity.—Not less than 60 per cent. of Curaçao Aloes is soluble in cold water, the solution being of a purplish-red color.

The powder is deep reddish-brown; when mounted in expressed oil of almond and examined under the microscope, it shows numerous blackish-brown, irregular, more or less opaque and angular fragments. Upon the addition of nitric acid, it yields immediately a deep red liquid.

Cape Aloes.—Official Description.—In reddish-brown or olive-black masses, usually covered with a yellowish powder, or in thin, transparent fragments of a reddish-brown color; fracture smooth and glassy.

Odor.—Odor characteristic.

Tests for Identity and Purity.—Not less than 60 per cent. of Cape Aloes is soluble in cold water, the solution being of a pale yellow color.

The powder is greenish-yellow, changing to light brown on aging; when mounted in expressed oil of almond and examined under the microscope, it shows numerous distinctly angular, bright yellow fragments. Upon the addition of nitric acid, it yields a liquid that is colored reddish-brown, changing to purplish-brown and finally greenish.

The tests which follow apply to Socotrine, Curaçao, and Cape Aloes.

Aloes contains not more than 10 per cent. of moisture.

Gum and Inorganic Impurities.—Add 50 mils of alcohol to 1 Gm. of Aloes, gently heat the mixture and then cool it; a nearly clear solution is obtained.

Intimately mix 1 Gm. of Aloes with 10 mils of hot water and dilute 1 mil of this mixture with 100 mils of water; a green fluorescence is produced upon the addition of an aqueous solution of sodium borate (1 in 20). Dilute 1 mil of the original aqueous mixture of Aloes with 100 mils of water, and shake it with 10 mils of benzene; upon separating the benzene solution and adding to it 5 mils of ammonia water, a permanent deep rose color is produced in the lower layer.

Aloes yields not more than 4 per cent. of ash.

U. S. P. Preparations.—Extractum Colocynthidis Compositum; Pilulæ Aloes; Pilulæ Rhei Compositæ; Tinctura Aloes; Tinctura Benzoini Composita.

N. F. Preparations.—Extractum Aloes; Pilulæ ad Prandium; Pilulæ Aloes et Asafœtidæ; Pilulæ Aloes et Ferri; Pilulæ Aloes et MasticHes; Pilulæ Aloes et Myrrhæ; Pilulæ Aloes et Podophylli Compositæ; Pilulæ Aloes, Hydrargyri et Scammonii Compositæ (from Tincture of Aloes and Myrrh); Pilulæ Antiperiodicæ (from Extract); Pilulæ Colocynthidis Compositæ; Pilulæ Colocynthidis et Hyoscyami; Pilulæ Ferri, Quininæ, Aloes et Nucis Vomicæ; Pilulæ Laxativæ Post Partum; Pulvis Aloes et Canellæ; Tinctura Aloes et Myrrhæ; Tinctura Antiperiodica (from Extract); Tinctura Zedoariæ Amara.

Uses.—Aloes is used as a cathartic and emmenagogue. Dose, four to twenty grains (0.25 to 1.3 Gm.).

ALOINUM. U. S. Aloin
[Aloin.]

A pentoside or mixture of pentosides obtained from aloes, varying in chemical composition, physical and chemical properties according to the source. Preserve it in well-closed containers, protected from light.

Aloin is usually made by dissolving 1 part of Curaçao or Barbadoes Aloes in 10 parts of boiling water acidulated with hydrochloric acid, and, after cooling, the liquid is decanted from the resinous matter, evaporated to about 2 parts, and set aside two weeks for crystals to form. The crystals are washed with acetic ether and dried. Socaloin and nataloin are not often found in commerce, as the aloes from which they would be prepared are both scarce and the products would be expensive.

Official Description.—Aloin occurs as a micro-crystalline powder or in minute acicular crystals from lemon-yellow to dark-yellow in color. It becomes darker on exposure to light and air.

Odor, Taste, and Reaction.—Odorless or possessing a slight odor of aloes and an intensely bitter taste. A saturated aqueous solution of Aloin is neutral or not more than faintly acid to litmus.

Solubility.—It varies in solubility with its composition. It is soluble in water, alcohol or acetone; slightly soluble in ether.

Tests for Identity and Purity.—Aloin is soluble in ammonia water and alkali hydroxide solutions, forming red solutions (or yellow solutions that soon become red) which exhibit a green fluorescence.

When added to alkaline solutions, Aloin is rapidly decomposed; when mixed with acid solutions decomposition is slower. A drop of ferric chloride T.S. added to an alcoholic solution of Aloin produces a brownish-green color.

The color of a saturated aqueous solution of Aloin is yellow, but changes to brown on standing.

Incinerate about 0.5 Gm. of Aloin; not more than 0.5 per cent. of ash remains.

Emodin.—Shake about 1 Gm. of Aloin with 10 mils of benzene for one minute and filter; the filtrate imparts not more than a faint, pink color to an equal volume of dilute ammonia water (5 per cent.) when shaken with it.

Dissolve about 1 Gm. of Aloin in 120 mils of distilled water, collect the insoluble residue, if any, on a filter tared after it has been dried at 100° C. (212° F.) and wash the residue with 25 mils of distilled water. This residue, when dried at 100° C. (212° F.), does not exceed 1.5 per cent.

N. F. Preparations.—Pilulæ Aloini Compositæ; Pilulæ Aloini, Strychninæ et Belladonnæ; Pilulæ Aloini, Strychninæ et Belladonnæ Compositæ; Pilulæ Laxativæ Compositæ.

Uses.—Aloin is used as a cathartic, in doses of two grains (0.13 Gm.). The laxative dose is one-quarter to one grain (0.015 to 0.065 Gm.).

COLOCYNTHIS. U. S. Colocynth

[**Colocyn.**—COLOCYNTH PULP BITTER APPLE COLOCYNTH APPLE]

The dried pulp of the fruit of *Citrullus Colocynthis* (Linné) Schrader (Fam. *Cucurbitaceæ*), without the presence or admixture of more than 5 per cent. of seeds or more than 2 per cent. of epicarp.

Official Description.—Fruits, before the removal of the seeds, nearly globular, from 4 to 7 cm. in diameter, usually more or less crushed and in broken pieces with occasional patches of the nearly smooth epicarp; yellowish-white or brownish; light, spongy; separable longitudinally when entire into three carpels, each containing, near the outer surface, the ovoid, compressed, yellowish seeds.

Odor and Taste.—Odor slight; taste intensely bitter.

Tests for Identity and Purity.—The powder is yellowish-white or buff, consisting chiefly of fragments of parenchyma cells and an occasional fragment with tracheæ; very few lignified tissues of the seed-coat, showing the characteristic stone cells which are nearly isodiametric, irregular, with either straight or undulate walls that are strongly lignified and possess simple pores; globules of fixed oil and aleurone grains very few.

Powdered Colocynth must be made from colocynth pulp containing not more than 5 per cent. of seeds and, upon extraction with purified petroleum benzin, yields not more than 2 per cent. of fixed oil.

Colocynth yields not more than 15 per cent. of ash.

U. S. P. Preparations.—Extractum Colocynthidis; Extractum Colocynthidis Compositum (from Extract).

N. F. Preparations.—Pilulæ Antiperiodicæ (from Compound Extract); Pilulæ Catharticæ Vegetabiles (from Compound Extract); Pilulæ Colocynthidis Compositæ (from Extract); Pilulæ Colocynthidis et Hyoscyami (from Extract); Pilulæ Colocynthidis et Podophylli (from Compound Extract); Pilulæ Laxativæ Post Partum (from Compound Extract).

Colocynth contains *colocynthin,* $C_{56}H_{84}O_{23}$, *colocynthitin,* gum, resin, etc. Colocynthin is a very bitter glucoside, splitting under the action of diluted acids into colocynthein and grape sugar. The seeds should be rejected as far as possible, not more than 5 per cent. being permitted by the U. S. P.

Uses.—Colocynth is a hydragogue cathartic. Dose, one to five grains (0.065 to 0.32 Gm.).

ELATERINUM. U. S. Elaterin
[Elaterin.]

A principle obtained from elaterium, a substance deposited by the juice of the fruit of *Ecballium Elaterium* (Linné) A. Richard (Fam. *Cucurbitaceæ*).

Preparation.—It may be made by evaporating an alcoholic tincture of elaterium to the consistence of thin oil, and throwing the residue while yet warm into a weak boiling solution of potassium hydroxide. The potassium hydroxide holds the green resin in solution, and the elaterin crystallizes as the liquor cools. Or it may be made by exhausting elaterium with chloroform, and adding ether to the solution, which precipitates the elaterin.

Elaterium.—When the fruit of the squirting cucumber is sliced and placed upon a sieve, a perfectly limpid and colorless juice flows out, which soon becomes turbid, and in the course of a few hours begins to deposit a sediment. This, when collected and carefully dried, is very light, and pulverulent, of a yellowish-white color, slightly tinged with green, and is called elaterium. The yield is small —only six grains from forty cucumbers—but the elaterium is very powerful, one-eighth of a grain purging violently. Commercial elaterium is not usually made in this way, but by expression or other processes, whereby the yield is increased. This elaterium is, of course, weaker.

Official Description.—Elaterin occurs in minute, white, hexagonal scales or prismatic crystals.

Odor, Taste, and Reaction.—Odorless, and having a slightly acrid, bitter taste; permanent in the air. Its alcoholic solution is neutral to moistened litmus paper.

Solubility.—One Gm. of Elaterin dissolves in 325 mils of alcohol, 15.5 mils of chloroform, 450 mils of ether, and in 310 mils of benzene at 25° C. (77° F.); also in 100 mils of boiling alcohol; it is insoluble in either cold or hot water.

Tests for Identity and Purity.—*Readily Carbonizable Impurities.*—Mix about 0.01 Gm. of Elaterin with 1 mil of sulphuric acid; only a yellow color is produced. On the addition of a drop of solution of formaldehyde the mixture becomes brown.

A solution of about 0.01 Gm. of Elaterin in 5 mils of melted phenol becomes crimson on the addition of a few drops of sulphuric acid and rapidly changes to scarlet.

No weighable ash remains on incinerating 0.1 Gm. of Elaterin.

Alkaloids.—Shake about 0.1 Gm. of Elaterin with a mixture of 9 mils of distilled water and 1 mil of diluted hydrochloric acid and filter; separate portions of the filtrate yield no turbidity with 0.5 mil of mercuric potassium iodide T.S. or with iodine T.S.

U. S. P. Preparation.—Trituratio Elaterini.

Uses.—Elaterin is the purgative principle of elaterium. The dose is one-twentieth to one-tenth of a grain (0.003 to 0.005 Gm.).

BRYONIA. N. F. Bryonia
[Bryon.—Bryony]

The dried root of *Bryonia alba* Linné or of *Bryonia dioica* Jacquin (Fam. *Cucurbitaceæ*), without the presence of more than 5 per cent. of foreign matter.

It contains starch, gum, sugar and *bryoresin* and the glucosides *bryonin* and *bryonidin*. *Bryogenin,* a resin, is also present.

Official Description.—Usually in circular or elliptical slices, obtained by cutting the root more or less transversely, from 1.5 to 10 cm. in breadth and from 3 to 15 mm. in thickness; the edges light gray or yellowish, rough and striate, the cut surface white or faintly yellow, showing a thin cortex and a wood with numerous projecting, collateral fibro-vascular bundles arranged in concentric zones; fracture short and mealy, whitish internally.

Odor and Taste.—Odor faint, but distinct and characteristic; taste bitter and nauseous.

Tests for Identity and Purity.—The powdered drug is of a light yellow color and, when examined under a microscope, shows simple, rounded, or two- or more compound, starch grains from 0.004 to 0.024 mm. in diameter, frequently with a central cleft, tracheæ from 0.035 to 0.25 mm. in width, reticulate or with bordered pores, and large yellow cork cells.

Add sulphuric acid to the powdered drug; it becomes reddish-brown and then brownish-purple.

Bryonia yields not more than 8 per cent. of ash.

N. F. Preparation.—Tinctura Bryoniæ.

Uses.—It is used as a purgative, diuretic, emmenagogue and abortifacient. Dose, fifteen grains (1 Gm.).

CASSIA FISTULA. N. F. Cassia Fistula
(U. S. P. VIII)

[Cass. Fist.—Purging Cassia]

The dried fruit of *Cathartocarpus Fistula* (Linné) Persoon (Fam. *Leguminosæ*).

It yields about 25 per cent. of pulp, which contains pectin, sugar, albuminous principles, salts, etc.

Official Description.—Cylindrical, from 25 to 50 cm. in length, about 20 mm. in diameter, chestnut-brown in color, on one side a longitudinal groove and on the other a smooth line or slight ridge, indicating the sutures; indehiscent, the cavity divided transversely into numerous compartments, each containing a reddish-brown, glossy, flattish-ovoid seed embedded in a blackish-brown sweet pulp.

Odor.—Odor resembling that of prunes.

N. F. Preparation.—Confectio Sennæ.

Uses.—The pulp is laxative. Dose, one drachm (4 Gm.).

EUONYMUS. N. F. Euonymus
(U. S. P. VIII)

[Euonym.—Wahoo Bark]

The dried bark of the root of *Euonymus atropurpureus* Jacquin (Fam. *Celastraceæ*), without the presence of more than 3 per cent. of wood or other foreign matter.

This bark contains resins, a bitter principle called *euonymin, euonic acid,* starch, asparagin, and pectin.

Official Description.—Usually in transversely curved pieces, occasionally in single quills from 2 to 7 cm. in length; bark from 1 to 2.5 mm. in thickness; very light in weight; outer surface grayish or light brown, somewhat wrinkled, occasionally transversely fissured from the lenticels and with scale patches of soft cork; inner surface grayish white, longitudinally striate and somewhat porous; fracture short with silky, projecting elastic fibers.

Odor and Taste.—Odor distinct; taste bitter and acrid.

Tests for Identity and Purity.—The powder is light brown, and when examined under the microscope shows numerous starch grains, nearly spherical, from 0.003 to 0.012 mm. in diameter; fragments of cork with nearly colorless, thin walls; secretion cells with yellowish or brownish amorphous contents; bast-fibers very long, with thin, non-lignified walls possessing numerous small, more or less oblique pores; numerous fragments of starch-bearing parenchyma; calcium oxalate in rosette aggregates from 0.015 to 0.035 mm. in diameter, the amount in different specimens showing some variation.

Euonymus yields not more than 12 per cent. of ash.

N. F. Preparations.—Extractum Euonymi; Fluidextractum Euonymi.

Uses.—Euonymus is used as a cholagogue, cathartic, and tonic. The dose is five to thirty grains (0.32 to 2 Gm.).

Caution.—It has been stated that the absorption of Euonymus in the gastro-intestinal tract is uncertain and irregular. To avoid an accumulation of the drug or toxic action, the physician should carefully guard the dosage and determine in each case the tolerance of the patient.

FICUS. N. F. Fig

(U. S. P. VIII)

The partially dried fruit of *Ficus Carica* Linné (Fam. *Moraceæ*). It contains mucilaginous constituents, sugar, fat, gum, etc.

Official Description.—Usually compressed, of irregular rounded shapes, from 2.5 to 5 cm. in diameter, fleshy, light brown to yellow, frequently with an efflorescence of sugar; summit with a small. scaly orifice; base with a scar or short stalk; internally hollow, with numerous small, brownish-yellow, glossy, and hard akenes.

Odor and Taste.—Odor distinctive, fruity; taste sweet, pleasant.

N. F. Preparations.—Confectio Sennæ; Syrupus Ficorum Compositus.

Uses.—They are nutritious, demulcent, and laxative.

LEPTANDRA. N. F. Leptandra

(U. S. P. VIII)

[**Leptand.**—Culver's Root]

The dried rhizome and roots of *Veronica virginica* Linné (Fam. *Scrophulariaceæ*), without the presence of more than 5 per cent. of stems or other foreign matter.

Leptandra contains a crystalline principle, *leptandrin,* resin, tannin, saponin, gum, mannite, etc. Crystalline leptandrin is bitter, and soluble in water, alcohol, and ether.

Official Description.—Rhizome usually of horizontal growth, nearly cylindrical, somewhat branched; branches readily separable from the main rhizome, from 4 to 10 cm. in length and from 4 to 13 mm. in diameter; externally grayish-brown to dark reddish-brown, annulate from circular scars of bud-scales, upper surface with short stem remnants, occasionally with buds, and numerous circular stem-scars; from the under and lateral portions arise numerous coarse roots; fracture very tough and woody; internally, bark rather thin, dark brown and resinous, wood about the same thickness as the bark, light brown and porous, pith large, more or less hollow, the color being similar to that of the bark. Roots from 1 to 10 cm. in length and from 1 to 2 mm. in diameter; externally dark brown to purplish-brown, smooth and faintly longitudinally wrinkled; fracture short; internally with a thick brownish-black bark and small light brown central cylinder.

Odor and Taste.—Nearly odorless; taste very bitter and acrid.

Tests for Identity and Purity.—The powder is brown to yellowish brown; odor strong, penetrating; consisting of numerous irregular fragments, many of them being colored pink or violet upon the addition of hydrated chloral T.S.; starch grains numerous, mostly in the parenchymatous cells, the individual grains nearly spherical or more or less polygonal, and from 0.002 to 0.008 mm. in diameter; tracheæ with spiral thickenings or with simple or bordered pores; wood-fibers with thick lignified walls, with simple pores or with bordered pores, resembling tracheids; fragments of parenchyma containing a light brown or brownish-black resin, the latter frequently closely coherent with the starch grains in the cells, thus preventing the separation of the individual starch grains; mounted in hydrated chloral T.S., occasional elongated cells with a lemon-yellow oily substance are observed.

Leptandra yields not more than 12 per cent. of ash.

N. F. Preparations.—Extractum Leptandræ; Fluidextractum Leptandræ; Pilulæ Catharticæ Vegetabiles (from Extract).

Uses.—Leptandra is cholagogue, cathartic, and alterative, in doses of fifteen to forty grains (1 to 2.6 Gm.).

PRUNUM. N. F. Prune

(U. S. P. VIII)

The partly dried, ripe fruit of *Prunus domestica* Linné (Fam. *Rosaceæ*). This fruit contains sugar, malic acid, pectin, salts, etc.

Official Description.—Oblong, ellipsoidal, more or less compressed, from 3 to 4 cm. in length; externally brownish-black, shriveled; the sarcocarp sweet and acidulous; putamen hard, smooth or irregularly ridged; seed, shaped like that of the almond but smaller.

Taste.—Bitter-almond like.

N. F. Preparation.—Confectio Sennæ.

Uses.—The pulp is laxative.

RHAMNUS CATHARTICA. N. F. Rhamnus Cathartica

[**Rhamn. Cath.**—Buckthorn Berries Baccæ Spinæ Cervinæ]

The dried, ripe fruit of *Rhamnus cathartica* Linné (Fam. *Rhamnaceæ*), without the presence of more than 5 per cent. of the unripe fruit or other foreign matter.

It contains *rhamnonigrin,* a glucoside, also *emodin,* coloring matter, fat, pectin, gum, etc.

Official Description.—Flattened, globoid or ovoid, from 4 to 8 mm. in diameter; externally purplish-black, wrinkled from shrinking of the mesocarp in drying; three- to four-celled, each cell containing a brown, triangular-convex, seed-like nutlet; in the fully dried, ripe fruit the pedicel is usually lacking.

Odor and Taste.—Odor faint, unpleasant; taste at first sweetish, then nauseating and bitter; it colors the saliva purplish-red.

Tests for Identity and Purity.—When macerated in water the drupe readily assumes its original globular shape, about 1 cm. in diameter. The expressed pulp is colored red by acids and greenish-yellow by alkalies.

Shake out an aqueous infusion of Rhamnus Carthartica with ether, separate the ethereal solution and shake it with 5 per cent. ammonia water; the ammonia solution assumes a cherry-red color.

The unripe fruit, which is to be rejected, is green to greenish-brown, firm, furrowed, pedicel usually attached; very bitter; it colors the saliva greenish-yellow.

Rhamnus Carthartica yields not more than 5 per cent. of ash.

N. F. Preparations.—Fluidextractum Rhamni Catharticæ; Syrupus Rhamni Catharticæ (from Fluidextract).

Uses.—A cathartic, used chiefly in veterinary practice. Dose, fifteen grains (1 Gm.).

Unofficial Drugs containing Cathartic Principles

Colutea Bladder Senna	The leaves of *Colutea arborescens* Linné (Fam. *Leguminosæ*). It is slightly purgative and is used chiefly in domestic treatment, in fusions (℥i to Oi)
Kamala (Rottlera). U. S. P. 1890	The glands and hairs from the capsules of *Mallotus philippinensis* (Lamarck) Mueller Arg. (Fam. *Euphorbiaceæ*). It contains *rottlerin*, resins, coloring matter, etc. Used as a tænifuge and purgative in doses of one to three drachms (4 to 12 Gm.) suspended in mucilage or syrup

Drugs containing Astringent Principles, and their Preparations

GALLA. U. S. Nutgall
[**Gall.**—ALEPPO GALLS SMYRNA GALLS]

Excrescences on the young twigs of *Quercus infectoria* Olivier and other allied species of *Quercus* (Fam. *Fagaceæ*), induced by the punctures on the leaf-buds and by the deposited ova of *Cynips tinctoria* Hartig (Order *Hymenopteræ*). Not more than 5 per cent. of Galls float in water.

Official Description.—Nearly globular, from 0.8 to 2.2 cm. in diameter; externally blackish-olive-green or blackish-gray, more or less tuberculated on the upper portion, the basal portion being nearly smooth and contracted into a short stalk; heavy, sinking in water, excepting the smaller galls; fracture short-horny; internally grayish or dark brown, consisting of a central portion slightly radiating and resinous, occasionally hollow and traversed by a narrow radial canal extending to the exterior as shown by the perforation in the whole gall.

Odor and Taste.—Odor slight; taste strongly astringent.

Tests for Identity and Purity.—The powder consists of numerous fragments of thick-walled starch-bearing parenchyma; starch grains numerous; more or less free in the powder and varying in shape from spherical or ellipsoidal to polygonal, and from 0.005 to 0.03 mm. in diameter; stone cells few, resembling those found in fruits and seeds, varying considerably in shape and size, and from 0.025 to 0.3 mm. in length; occasional fragments with spiral or reticulate tracheæ; fragments mounted in dilute ferric chloride T.S. assume a deep blue or greenish-blue color.

Macerate 0.5 Gm. of the powdered Nutgall with 2 mils of alcohol for a few minutes, add 500 mils of water, stir the mixture well for five minutes and filter. Take 1 mil of the light yellowish-brown solution, and dilute it with 10 mils of water; it shows a distinct blue or violet-blue color upon the addition of a drop of ferric chloride T.S.

U. S. P. Preparation.—Unguentum Gallæ.
N. F. Preparations.—Elixir Rubi Compositum; Tinctura Gallæ.

Nutgall contains about 50 per cent. of tannin, 2 per cent. of gallic acid, sugar, gum, resin, and starch.

Uses.—It is used as an astringent. Dose, eight to fifteen grains (0.5 to 1 Gm.).

ACIDUM TANNICUM. U. S. Tannic Acid
[**Acid. Tann.**—GALLOTANNIC ACID TANNIN]

A tannin usually obtained from nutgalls. Preserve it in well-closed containers, in a cool place, protected from light.

Preparation.—Tannic acid, or *Tannin*, may be made by the modification of Leconnet's method, which was formerly official, as follows:

Take of nutgall, in fine powder, ether, each, a sufficient quantity.

Expose the nutgall to a damp atmosphere for twenty-four hours, and then mix it with sufficient ether, previously washed with water, to form a soft paste. Set this aside, covered closely, for six hours; then, having quickly enveloped it in a close canvas cloth, express it powerfully between tinned plates, so as to obtain the liquid portion. Reduce the resulting cake to powder, and mix it with sufficient Ether, shaken with one-sixteenth of its bulk of water, to form again a soft paste, and express as before. Mix the liquids, and allow the mixture to evaporate spontaneously until it assumes a syrupy consistence; then spread it on glass or tinned plates, and dry it quickly in a drying closet. Lastly, remove the dry residue from the plates with a spatula, and keep it in a well-stoppered bottle.

The explanation of this process is that water and ether form a soluble compound with tannic acid, which may be separated from the nutgall residue by expression; then, by exposing the thick solution to heat, the ether and water are evaporated, leaving the tannic acid in soft, cellular, friable scales upon the plates.

Official Description.—It occurs as a yellowish-white to light brown, amorphous powder, gradually turning darker when exposed to air and light, usually cohering in the form of glistening scales or spongy masses.

Odor, Taste, and Reaction.—Odorless, or having a faint, characteristic odor, and a strongly astringent taste. An aqueous solution of Tannic Acid (1 in 20) is acid to litmus.

Solubility.—One Gm. of Tannic Acid dissolves in 1 mil of glycerin with the application of a moderate heat; very soluble in water and alcohol at 25° C. (77° F.) and in boiling water and boiling alcohol; freely soluble in diluted alcohol, slightly soluble in dehydrated alcohol and almost insoluble in ether, chloroform, benzene, or petroleum benzin.

Tests for Identity.—The addition of a small quantity of ferric chloride T.S. to an aqueous solution of the Acid produces a bluish-black color or precipitate.

An aqueous solution of Tannic Acid produces precipitates with nearly all alkaloids and glucosides, and with solutions of gelatin, albumin, and starch.

Impurities and Tests for Impurities.—Tannic Acid does not lose more than 12 per cent. of its weight when dried to constant weight at 100° C. (212° F.).

Incinerate about 1 Gm. of Tannic Acid in a platinum dish; not more than 0.6 per cent. of ash remains.

Gum or Dextrin.—Dissolve about 2 Gm. of Tannic Acid in 10 mils of hot distilled water; the solution is not more than slightly turbid, and no turbidity is produced on diluting 5 mils of the cooled and filtered solution with twice its volume of alcohol or *Resinous Substances.*—with twice its volume of distilled water.

U. S. P. Preparations.—Glyceritum Acidi Tannici; Trochisci Acidi Tannici; Unguentum Acidi Tannici.

N. F. Preparations.—Collodium Stypticum; Syrupus Iodotannicus.

Uses.—Tannic acid is powerfully astringent, in doses of three to ten grains (0.2 to 0.65 Gm.). Its solution in glycerin is a valuable liquid form of administration.

ACIDUM GALLICUM. U. S. Gallic Acid

[Acid. Gallic.]

An organic acid [$C_7H_6O_5 + H_2O$ or $C_6H_2(OH)_3.COOH$ 1 : 3 : 4 : 5 $+ H_2O = 188.06$].

Preparation.—The former official process may be used for making gallic acid. Take of nutgall, in fine powder, 36 oz.; purified animal charcoal, distilled water, each, a sufficient quantity. Mix the nutgall with sufficient distilled water to form a thin paste, and expose the mixture to the air, in a shallow glass or porcelain vessel, in a warm place, for a month, occasionally stirring it with a glass rod, and adding from time to time sufficient distilled water to preserve the semifluid consistence. Then submit the paste to expression, and, rejecting the expressed liquor, boil the residue in 8 pints of distilled water for a few minutes, and filter while hot through purified animal charcoal. Set the liquid aside that crystals may form, and dry them on bibulous paper. If the crystals are not sufficiently free from color, they may be purified by dissolving them in boiling distilled water, filtering through a fresh portion of purified animal charcoal, and again crystallizing. Gallic acid may be prepared synthetically. It is closely related to tannic acid, and both are usually found together in the same plants.

Official Description.—It occurs in white, or pale fawn-colored, silky, interlaced needles, or in triclinic prisms.

Odor, Taste, and Reaction.—Odorless and having an astringent and slightly acidulous taste; permanent in the air. A saturated aqueous solution of Gallic Acid is acid to litmus.

Solubility.—One Gm. of Gallic Acid dissolves in 87 mils of water, 4.6 mils of alcohol, 10 mils of glycerin, and in about 100 mils of ether at 25° C. (77° F.); also in about 3 mils of boiling water; almost insoluble in chloroform.

Tests for Identity.—Add 6 drops of sodium hydroxide T.S. to 5 mils of a cold, saturated aqueous solution of the Acid; a deep green color gradually develops, which is changed to reddish or brownish-red by acids.

Gallic Acid neither colors nor precipitates solutions of pure ferrous salts, but it forms a bluish-black precipitate with ferric salts.

Impurities and Tests for Impurities.—When dried to constant weight at 100° C. (212° F.), the Acid loses not more than 12 per cent. of its weight.

Incinerate about 1 Gm. of Gallic Acid; not more than 0.1 per cent. of ash remains.

Tannic Acid.—A cold saturated aqueous solution of Gallic Acid yields no precipitate with gelatin T.S. or starch T.S.

Uses.—Gallic acid is used as an astringent. Dose, five to fifteen grains (0.32 to 1 Gm.).

PYROGALLOL. U. S. Pyrogallol

[Pyrogall.—PYROGALLIC ACID]

Trihydroxybenzene [$C_6H_3(OH)_3$ 1 : 2 : 3 = 126.05]. Preserve it in well-closed containers, protected from light.

When gallic acid is sublimed, it is converted by the heat into pyrogallol and carbon dioxide.

$$\underset{\text{Gallic Acid}}{C_7H_6O_5} = \underset{\text{Pyrogallol}}{C_6H_6O_3} + \underset{\substack{\text{Carbon}\\\text{Dioxide}}}{CO_2}$$

Official Description.—It occurs in light, white, or nearly white laminæ or fine needles. It acquires a grayish tint on exposure to air and light.

Odor and Taste.—Odorless and having a bitter taste.

Solubility.—One Gm. of Pyrogallol dissolves in 1.7 mils of water, 1.3 mils of alcohol, and in 1.6 mils of ether at 25° C. (77° F.); very soluble in boiling water or boiling alcohol.

Tests for Identity.—It melts between 129° and 133° C. (264.2–271.4° F.).

An aqueous solution of Pyrogallol (1 in 10) reduces solutions of salts of silver, gold, and mercury even in the cold.

Impurities and Tests for Impurities.—When freshly prepared, 1 mil of an aqueous solution of Pyrogallol (1 in 20) is colored brownish-red by a few drops of ferric chloride T.S. A blue color is produced in an aqueous solution of Pyrogallol (1 in 20) by freshly prepared ferrous sulphate T.S.

Incinerate about 1 Gm. of Pyrogallol; not more than 0.1 per cent. of ash remains.

A freshly prepared solution of Pyrogallol (1 in 20), in recently boiled distilled water, is colorless or at most slightly yellow, and is neutral or only slightly acid to litmus. The solution gradually acquires a brown color on exposure to the air and an acid reaction due to the absorption of oxygen; the absorption of oxygen and change of color take place very rapidly if the solution contains an alkali hydroxide.

Uses.—Pyrogallol is used in the form of ointment in the treatment of psoriasis, although its use is not without danger; it is also employed in photography.

GAMBIR. U. S. Gambir
[Pale Catechu]

A dried extract prepared from decoctions of the leaves and twigs of *Ourouparia Gambir* (Hunter) Baillon (Fam. *Rubiaceæ*).

Official Description.—Usually in cubical or rectangular pieces from 20 to 30 mm. in diameter; externally pale grayish-brown to reddish-brown, more or less dull and porous; friable; internally of a light brown or dull earthy color.

Odor and Taste.—Inodorous; taste bitterish and very astringent.

Tests for Identity and Purity.—Upon scraping a piece of Gambir and mounting the separated fragments in hydrated chloral T.S. and examining them under the microscope, numerous acicular crystals, from 0.01 to 0.03 mm. in length, separate at the edges of the fragments and gradually dissolve, leaving a few, thick-walled, non-glandular hairs which, when entire, may be 0.35 mm. in length; a few fragments of leaves may also be present showing either epidermal cells or small narrow tracheæ with spiral or annular markings; a few starch grains either single or compound, of variable shapes and from 0.005 to 0.015 mm. in diameter; a number of bacteria may also be present.

Macerate 1 Gm. of Gambir with 50 mils of water, and filter; the pale yellowish-brown solution obtained gives an intense green color with dilute ferric chloride T.S., but yields no precipitate with copper sulphate T.S.

Not less than 65 per cent. of Gambir is soluble in water and not less than 60 per cent. is soluble in alcohol.

Gambir yields not more than 9 per cent. of ash.

U. S. P. Preparation.—Tinctura Gambir Composita.

N. F. Preparations.—Pulvis Gambir Compositus; Tinctura Pectoralis (from Compound Tincture); Trochisci Gambir.

Gambir was introduced into the U. S. P. (8th Rev.) to replace catechu, because the former can be obtained in commerce much more uniform in quality. It contains *catechutannic acid,* a peculiar form of tannin, which is insoluble in ether and turns greenish-black with ferric salts. *Catechin* and *catechol* are also present. Owing to the decomposition of the tannic acid, the liquid preparations often gelatinize.

Uses.—It is used as an astringent and tonic. Dose, fifteen grains (1 Gm.).

KINO. U. S. Kino

The spontaneously dried juice of *Pterocarpus Marsupium* Roxburgh (Fam. *Leguminosæ*).

Official Description.—In small, brittle, angular fragments, usually considerably less than 15 mm. in diameter, varying in color from dark reddish-brown to reddish-black; when crushed upon a slide and examined under the microscope the angular fragments are more or less translucent with a glass-like, conchoidal surface, the thinner pieces having a yellowish-red or deep brownish-red color, the pieces often being marked by nearly parallel, curved and straight lines.

Odor and Taste.—Inodorous; taste very astringent; when masticated it colors the saliva somewhat pink.

Tests for Identity and Purity.—The powder is of a dark brick-red color; upon the addition of water, the sharp angular fragments assume a deep rich-red color and become more or less rounded and separate into innumerable small, granular particles among which are a large number of rod-shaped bacteria. On mounting powdered Kino in alcohol the fragments at first assume a deep red color, then mostly dissolve, leaving a number of small, colorless granules and indistinguishable, cellular fragments.

Kino is only partly soluble in cold water, and not less than 40 per cent. is soluble in boiling water. The latter solution, when cooled and filtered, shows a faintly acid reaction, gives a dark green precipitate with ferric chloride T.S. and a reddish-violet color with alkalies.

The yield of alcoholic extractive is not less than 45 per cent.

Kino contains not more than 12 per cent. of moisture, and yields not more than 3 per cent. of ash.

U. S. P. Preparation.—Tinctura Kino.

N. F. Preparations.—Pulvis Kino et Opii Compositus; Tinctura Kino et Opii Composita (from Tincture).

Kino contains *kinotannic acid,* pyrocatechin, kino red, kinoin, gum, etc. Owing to the decomposition of the kinotannic acid, the liquid preparations, if not protected, frequently gelatinize. Tincture of kino is heated to destroy an enzyme which it is said induces gelatinization by aiding in the decomposition of the kinotannic acid.

Uses.—Kino is used as an astringent and tonic. Dose, five to twenty grains (0.32 to 1.3 Gm.).

ROSA GALLICA. U. S. Red Rose

[Rosa Gall.]

The dried petals of *Rosa gallica* Linné (Fam. *Rosaceæ*), collected just before the expansion of the flower. Preserve Red Rose in tightly-closed containers, protected from the light.

Official Description.—Petals either separate or imbricated in small cones, broadly ovate, summit rounded and deeply notched, margin entire and somewhat recurved, base obtuse; externally of a purplish-red color except the light-brown claw; texture velvety; when dry brittle.

Odor and Taste.—Odor agreeable; taste astringent and slightly bitter.

Tests for Identity and Purity.—Under the microscope, transverse sections of the petals of Red Rose show the upper epidermal cells modified to conical papillæ and containing a purplish-red cell sap; a loose mesophyll composed of from 2 to 10 rows of cells among which are the fibro-vascular bundles with spiral tracheæ, and a lower epidermis of rectangular cells filled with a purple cell sap.

Red Rose yields not more than 3.5 per cent. of ash.

U. S. P. Preparation.—Fluidextractum Rosæ.

N. F. Preparations.—Confectio Rosæ; Infusum Rosæ Compositum; Pilulæ Aloes et Mastiches; Syrupus Rosæ (from Fluidextract).

Red rose contains *quercitrin* and *quercitannic acid.* The pale red coloring matter is made bright red by the addition of sulphuric acid.

Uses.—It is slightly astringent and tonic. The infusion of red rose is an elegant vehicle for many substances. (See page 455.)

CASTANEA. N. F. Castanea

[Castan.—CHESTNUT LEAVES]

The dried leaves of *Castanea dentata* (Marshall) Borkhausen (Fam. *Fagaceæ*), collected in September or October while still green, and without the presence of more than 5 per cent. of twigs or other foreign matter.

It contains about 9 per cent. of tannic acid and also mucilage.

Official Description.—Petioles stout, about 12 mm. in length; blades entire or slightly broken and usually folded or matted together; about 15 to 25 cm. in length and about 5 cm. in breadth, oblong-lanceolate, apex attenuate, acute at the base, coarsely and sharply serrate with ascending, attenuate teeth, nearly smooth, coriaceous in texture; the upper surface dark green, the lower light green; distinctly pinnately veined, the veins of the first order diverging at an angle of about 60 degrees, each terminating in one of the teeth.

Odor and Taste.—Odor slight; taste astringent.

Tests for Identity and Purity.—The powdered drug, when examined under the microscope, shows a few non-glandular hairs from 0.1 to 0.5 mm. in length, nearly smooth, thick-walled, distinctly yellow, occasionally in groups of three to eight and spreading

from the base; numerous calcium oxalate crystals in rosette aggregates or in monoclinic prisms, from 0.01 to 0.04 mm. in diameter; parenchyma cells containing irregular yellowish-brown tannin masses which are colored blue with ammonio-ferric alum T.S.
Castanea yields not more than 5 per cent. of ash.

N. F. Preparation.—Fluidextractum Castaneæ.

Uses.—A respiratory sedative, much used in whooping-cough. Dose, one drachm (4 Gm.).

CHIMAPHILA. N. F. Chimaphila

(U. S. P. VIII)

[**Chimaph.**—PIPSISSEWA]

The dried leaves of *Chimaphila umbellata* (Linné) Barton (Fam. *Ericaceæ*), without the presence of more than 5 per cent. of stems or other foreign matter.

Chimaphila contains about 5 per cent. of tannic acid, with *chimaphilin, ericolin, arbutin, urson,* sugar, gum, etc.

Official Description.—Oblanceolate, from 2.5 to 7 cm. in length and from 8 to 20 mm. in breadth, the upper portion coarsely and sharply serrate, acute or somewhat obtuse, the lower wedge-shaped and nearly entire; coriaceous, smooth and uniformly dark green on the upper surface, paler beneath, the veins prominent.

Odor and Taste.—Odor slight; taste astringent and bitter.

Tests for Identity and Purity.—The powdered drug is brownish-green and, when examined under the microscope, exhibits characteristic epidermal tissue composed of cells with unevenly thickened, porous and wavy vertical walls; the fragments from the lower epidermis show numerous broadly elliptical stomata up to 0.04 mm. in length, the epidermal tissue in transverse view shows outer walls from 0.008 to 0.015 mm. in thickness; fragments of palisade and mesophyll tissue containing chloroplastids; tracheæ with spiral or annular markings; a few characteristic, elongated tracheæ-like cells, about 0.014 mm. in width, thick-walled, slightly lignified and with minute, double-spiral bands or delicate reticulations; fragments of the epidermis from the stems and root-stocks, the cells containing a purplish coloring substance which is intensified when the powder is mounted in hydrated chloral T.S.; parenchyma cells containing a reddish-brown amorphous substance; calcium oxalate in rosette aggregates mostly about 0.035 mm. in diameter, occasionally up to 0.065 mm. in diameter; starch grains few, rounded, simple, up to 0.016 mm. in diameter and sometimes with a central cleft or fissure, or two- to four-compound; trichomes absent.
Chimaphila yields not more than 7 per cent. of ash.

N. F. Preparations.—Fluidextractum Chimaphilæ; Fluidextractum Stillingiæ Compositum.

Uses.—It is used as an astringent, diuretic, and tonic, in doses of thirty grains (2 Gm.).

GERANIUM. N. F. Geranium

(U. S. P. VIII)

[**Geran.**—CRANESBILL]

The dried rhizome of *Geranium maculatum* Linné (Fam. *Geraniaceæ*).

Geranium contains about 15 per cent. of tannic acid, with brownish-red coloring matter, starch, sugar, pectin, etc.

Official Description.—Rhizome cylindraceous, somewhat branched, bent, flattened and strongly tuberculated, from 2.5 to 10 cm. in length and from 3 to 15 mm. in diameter; surface marked with root scars and remnants of slender roots, longitudinally wrinkled; externally dark purple-brown; internally light purple-brown; fracture short, non-fibrous, the section shows a thin bark, a distinct cambium, irregular in outline, large central pith, wood indistinct, the fibro-vascular bundles few and at unequal distances.

Odor and Taste.—Odorless; taste strongly astringent.

Tests for Identity and Purity.—The powder is purplish-brown and, when examined under the microscope, exhibits tangentially elongated cork cells; parenchyma containing starch, scattered cells of pith and bark parenchyma containing tannin both in the content and walls of the cells and colored bluish-black by ammonio-ferric alum T.S.; tracheæ small, with scalariform markings; characteristic starch more or less abundant, grains smooth, mostly single, ovate, up to 0.035 mm. in length, hilum near the larger end, inner lamellæ concentric with hilum, the outer excentric.

Geranium yields not more than 8 per cent. of ash.

N. F. Preparation.—Fluidextractum Geranii.

Uses.—It is used as an astringent and tonic. Dose, fifteen grains (1 Gm.).

HÆMATOXYLON. N. F. **Hematoxylon**

(U. S. P. VIII)

[**Hæmatox.**—Logwood]

The heart-wood of *Hæmatoxylon campechianum* Linné (Fam. *Leguminosæ*) that has not undergone fermentation.

It contains about 12 per cent. of the crystalline substance *hematoxylin*, $C_{16}H_{14}O_6$, a colorless, sweet principle, which is reddened upon exposure to light, and turned blackish purple upon contact with alkalies, yielding *hematëin*, $C_{16}H_{12}O_6.H_2O$ (see Reagents, Chapter LXII); it also contains tannin, extractive, and a little volatile oil.

Official Description.—Usually in small chips, reddish-brown, the freshly cut surface dark yellowish-red; a transverse section of the wood shows medullary rays which are up to four cells wide.

Odor and Taste.—Odor faint, agreeable; taste sweetish, astringent.

Tests for Identity and Purity.—Hematoxylon imparts a yellowish color to water containing a little acid, the color being changed to purple or violet-red by alkalies.

The powder is reddish-brown and, when examined under the microscope, exhibits medullary ray cells in one to seven rows; wood-fibers, long, with thickened walls; wood parenchyma with occasional crystals of calcium oxalate; tracheæ from 0.09 to 0.17 mm. in width; walls of the cells colored brownish-red, the inner cells containing resin masses.

Hematoxylon yields not more than 3.5 per cent. of ash.

Uses.—A mild astringent and tonic; used in diarrhœa. Dose, ten to thirty grains (0.65 to 2 Gm.). Hematoxylon is used as an indicator in volumetric analysis and the wood is used in the dye industry.

HAMAMELIDIS FOLIA. N. F. **Hamamelis Leaves**

(U. S. P. VIII)

[**Hamamel. Fol.**—Witch Hazel Leaves]

The dried leaves of *Hamamelis virginiana* Linné (Fam. *Hamamelidaceæ*), collected in autumn before the flowering of the plants, and without the presence of more than 10 per cent. of stems or other foreign matter.

It contains small amounts of tannin and bitter principles and a volatile oil.

Official Description.—Petioles from 1 to 1.5 cm. in length; laminæ when entire, broadly elliptical or rhomboid-ovate, usually inequilateral, mostly from 8 to 12 cm. in length; summits usually acute, sometimes rounded or acuminate; bases slightly heart-shaped and oblique; margins sinuate or sinuate-dentate; upper surfaces pale or brownish-green, occasionally dark brown with a few stiff, straight hairs; lower surfaces lighter in color, somewhat hairy, midrib and veins prominent.

Odor and Taste.—Odor slight; taste astringent, slightly aromatic and bitter.

Tests for Identity and Purity.—Transverse sections show, in addition to the epidermal layers, a palisade layer consisting of a single row of cells and a dorsal pneumatic tissue made up of three to six rows of strongly branching cells; large collateral, fibro-vascular bundles occur in the midrib and petiole, the tracheæ narrow, mostly spiral and associated with numerous narrow, strongly lignified and porous wood-fibers; around the phloem occurs a nearly continuous circle of bast-fibers, possessing strongly lignified walls; calcium oxalate in monoclinic prisms, from 0.01 to 0.035 mm. in diameter, either in the cells of the mesophyll or in crystal fibers associated with the bast-fibers.

Under the microscope, surface sections of Hamamelis Leaves show upon the lower surface narrow elliptical stomata, about 0.015 mm. in length and with two or four neighboring cells; from both surfaces, but especially from the under surface, arise stellate hairs composed of from four to twelve cells united at the base, the individual cells being from 0.02 to 0.075 mm. in length, either straight or more or less bent and with very thick walls and narrow lamina, the latter sometimes only apparent in the lower portion of the cells.

Hamamelis Leaves yield not more than 6 per cent. of ash.

Uses.—It has been extensively used as an astringent and hemostatic, but its virtues have been greatly exaggerated. Dose, thirty grains (2 Gm.).

KRAMERIA. N. F. Krameria

(U. S. P. VIII)

[**Kramer.**—RHATANY]

The dried root of *Krameria triandra* Ruiz et Pavon, known in commerce as Peruvian Rhatany, or of *Krameria Ixina* Linné, known in commerce as Savanilla Rhatany, or *Krameria argentea* Martius, known in commerce as Para or Brazilian Rhatany (Fam. *Leguminosæ*), without the presence of more than 5 per cent. of stems or other foreign matter.

The chief constituent is *krameria-tannic acid,* also starch, sugar, gum, and *krameric acid.*

Peruvian Rhatany.—Official Description.—It consists of a knotty, several to many-headed crown with numerous branching roots, the latter rarely attaining a length of 50 cm. and usually less than 1 cm. in thickness, cylindrical, somewhat tapering, and flexuous or wavy; externally light reddish-brown or brownish-red, more or less marked with dark scaly cork, especially in the upper portion, otherwise nearly smooth, somewhat longitudinally wrinkled and devoid of transverse fissures, fracture of bark slightly fibrous, of wood tough and splintery, the pinkish-brown bark less than one-third of the radius, the wood yellowish or pinkish-white and finely radiate.

Odor and Taste.—Inodorous; wood nearly tasteless, bark astringent.

Savanilla Rhatany and Para Rhatany.—Official Description.—Roots usually separate, less flexuous and tapering than those of Peruvian Rhatany, and usually not exceeding 12 mm. in thickness; externally purplish-brown or chocolate-brown and marked with numerous transverse fissures; fracture less tough than that of Peruvian Rhatany; internally the bark and wood darker, the bark about two-fifths or more of the radius and more astringent than that of Peruvian Rhatany.

Odor and Taste.—Inodorous; wood nearly tasteless, bark astringent.

Tests for Identity and Purity.—Powdered Krameria is reddish-brown; starch grains simple or two- to four-compound, the individual grains spherical, ellipsoidal, or plano-convex, and sometimes with a central, radial or star-like cleft, from 0.003 to 0.035 mm. in diameter; bast-fibers more or less wavy in outline with very much attenuated ends and with non-lignified walls; tracheæ with simple or bordered pores associated with numerous wood-fibers which are narrow-spindle shaped and with thick, porous, slightly lignified walls; numerous cellular fragments with yellowish or reddish-brown walls; calcium oxalate in monoclinic prisms, from 0.01 to 0.1 mm. in length, few or frequently absent.

Macerate 2 Gm. of powdered Krameria with 10 mils of alcohol, with occasional stirring for one hour, and filter. The deep reddish colored filtrate obtained yields a dark brownish-red precipitate and a deep orange-red filtrate upon the addition of an excess of alcoholic lead acetate T.S.; this latter filtrate yields no precipitate upon the further addition of a drop or two of alcoholic lead acetate T.S., and yields an olive-brown solution having a purplish fluorescence upon the addition of a drop or two of ferric chloride T.S.

Krameria yields not less than 9 per cent. of aqueous extractive and not more than 5 per cent. of ash.

N. F. Preparations.—Extractum Krameriæ; Fluidextractum Krameriæ; Fluidglyceratum Krameriæ; Pulvis Gambir Compositus; Syrupus Krameriæ; Tinctura Krameriæ.

Uses.—It is a tonic and astringent, used in diarrhœa and leucorrhœa. Dose, fifteen grains (1 Gm.).

QUERCUS. N. F. Quercus

(U.S.P. VIII)

[Querc.—White Oak Bark]

The dried bark of the trunk and branches of *Quercus alba* Linné (Fam. *Fagaceæ*), deprived of the periderm.

The most important constituents are *quercitannic acid* and *oak-red,* also pectin, resin, wax, fat, the sugar *quercit,* etc.

Official Description.—In nearly flat pieces, from 2 to 10 mm. in thickness; externally light brown, becoming darker with age, rough-fibrous; fracture uneven, coarsely fibrous.

Odor and Taste.—Odor distinct; taste strongly astringent; not tingeing the saliva yellow when chewed.

Test for Identity and Purity.—Quercus yields not more than 7 per cent. of ash.

N. F. Preparation.—Fluidextractum Quercus.

Uses.—It is an astringent, used in diarrhœa and leucorrhœa, also in hemorrhoids, and as a gargle. Dose, fifteen grains (1 Gm.).

RUBUS. N. F. Rubus

(U. S. P. VIII)

[Blackberry Bark]

The dried bark of the rhizome of *Rubus villosus* Aiton, *Rubus nigrobaccus* Bailey, or of *Rubus cuneifolius* Pursh (Fam. *Rosaceæ*).

Rubus owes its astringent properties to tannic acid. There are also present gum, coloring matter, etc.

Official Description.—In elongated, tough, flexible quills or bands, from 3 to 6 mm. in diameter, the bark from 1 to 2 mm. in thickness; outer surface deep red-brown or dark gray-brown, occasionally blackish-brown, somewhat scaly; inner surface yellow or pale brown, strongly and coarsely long straight-striate; fracture tough-fibrous; readily splitting.

Odor and Taste.—Inodorous; taste strongly astringent and bitter.

Test for Identity and Purity.—Rubus yields not more than 5 per cent. of ash.

N. F. Preparations.—Elixir Rubi Compositum; Fluidextractum Rubi; Syrupus Rubi (from Fluidextract).

Uses.—Rubus is used as an astringent. The dose is fifteen grains (1 Gm.).

RUMEX. N. F. Rumex

[Yellow Dock Curled Dock]

The roots of *Rumex crispus* Linné, or of *Rumex obtusifolius* Linné (Fam. *Polygonaceæ*), without the presence of more than 5 per cent. of stem bases.

It contains *rumicin,* said to be isomeric with chrysophanic acid. *Nepodin* and *lapodin* are also present.

Official Description.—Usually split longitudinally or cut into transverse pieces about 2 cm. in length. The entire root, nearly simple, slightly tapering, with few if any rootlets, somewhat twisted, up to 30 cm. in length and 7 cm. in diameter, externally reddish-brown or grayish from adhering soil, finely annulate above, deeply wrinkled longitudinally, marked with small indented root scars which are often transversely elongated and with occasional stem scars or remains of stems, the latter being hollow and finely striated; leaf buds few, obconical; fracture short and dusty, somewhat fibrous.

The transverse section exhibits a yellowish or brownish cortex and a whitish or yellowish wood which is finely radiate in the outer portion. When examined under the microscope, it exhibits a thick cortex with several layers of cork, beneath which is an interrupted row of stone cells; a distinct cambium; and vascular bundles with few fibers.

Tests for Identity and Purity.—The powder, when examined under the microscope, shows calcium oxalate crystals in rosette aggregates from 0.025 mm. to 0.06 mm. in diameter; numerous starch grains ellipsoidal or narrowly elongated, sometimes truncate, up to 0.025 mm. in length; stone cells from 0.04 mm. to 0.2 mm. in diameter, with walls somewhat lamellated, from 0.008 mm. to 0.025 mm. in thickness and with few simple pores; sclerenchymatous fibers few, thin-walled with simple pores; tracheæ up to 0.1 mm. in width with scalariform or reticulate thickenings of the wall; cork cells light brown.

Rumex yields not more than 10 per cent. of ash.

N. F. Preparation.—Fluidextractum Rumicis.

Uses.—It is used as an astringent and tonic, applied locally in scrofulous disorders. Dose, one drachm (4 Gm.).

UVA URSI. U. S. Uva Ursi

[Bearberry]

The dried leaves of *Arctostaphylos Uva-ursi* (Linné) Sprengel (Fam. *Ericaceæ*), without the presence or admixture of more than 5 per cent. of stems or other foreign matter.

Official Description.—Usually more or less entire, laminæ obovate or oblong-spatulate, from 12 to 30 mm. in length and from 5 to 13 mm. in breadth; summits obtuse or rounded; margins entire, slightly revolute; bases cuneate, tapering into short, stout petioles; upper surfaces dark green, glabrous and shiny, finely reticulate; under surfaces yellowish-green and slightly pubescent, especially on the midribs; coriaceous, fracture short.

Odor and Taste.—Odor aromatic, tea-like; taste astringent and somewhat bitter.

Tests for Identity and Purity.—The powder is olive green; under the microscope it shows irregular fragments; epidermal cells polygonal, those of the lower surfaces showing broadly elliptical stomata about 0.035 mm. in length, surrounded by from 5 to 8 neighboring cells; cells of mesophyll with chloroplastids and frequently irregular masses of a carbohydrate; fragments of fibro-vascular bundles with spiral tracheæ associated with narrow, strongly lignified sclerenchymatous fibers and frequently also with crystal fibers with monoclinic prisms, from 0.006 to 0.015 mm. in diameter; numerous fragments made up of cells having a yellowish-brown content which are colored a bluish-black upon the addition of ferric chloride T.S.

Place 0.1 Gm. of powdered Uva Ursi on a watch crystal and cover with another watch crystal and gently heat the powder; a crystalline sublimate forms, consisting of long rods and feather-like aggregates which polarize light with a brilliant play of colors.

Macerate 1 Gm. of powdered Uva Ursi with 10 mils of boiling water, shake the mixture occasionally until cold and then filter it; the filtrate yields a grayish-purple precipitate upon the addition of a few drops of ferrous sulphate T.S.

U. S. P. Preparation.—Fluidextractum Uvæ Ursi.

N. F. Preparations.—Elixir Buchu Compositum (from Compound Fluidextract of Buchu); Fluidextractum Buchu Compositum.

Uva ursi contains about 6 per cent. of tannic acid, with gallic acid, *urson, arbutin, ericolin,* gum, resin, coloring matter, etc.

Uses.—It is used as a diuretic, astringent, and tonic. Dose, thirty grains (2 Gm.).

Unofficial Astringent Substances

Agrimonia Agrimony	From *A. Eupatoria*, grown in North America. It contains tannin and bitter principle
Areca Nut Semen Arecæ (Betel Nut)	Vermifuge. Dose, one to two drachms (4 to 8 Gm.)
Bistorta Bistort	The rhizome of *Polygonum B.*, grown in Canada and the United States. It contains about 20 per cent. of tannin, etc.
Catechu Catechu, U. S. P. 1890	From *Uncaria Gambir*, grown in the East India Islands. It contains catechin, catechutannin, etc. (see Gambir p. 1298)
Comptonia Sweet Fern	The leaves of *C. asplenifolia*, found in North America. It contains volatile oil, tannin, etc.
Diospyros Persimmon	The bark of *D. virginiana*, grown in the United States. It contains tannin and malic acid
Epigæa Trailing Arbutus	From *E. repens*, found in North America. It contains tannin, and the principles common to the *Ericaceæ*
Epilobium Willow Herb	From *E. angustifolium*, found in the Northern Hemisphere. It contains tannin, mucilage, etc.
Epiphegus Beech-drop	From *E. virginiana*, a parasitic plant found in North America. It contains tannin, bitter principle, etc.
Eugallol (Pyrogallol-mono-acetate)	A brownish yellow, syrupy liquid, soluble in water. Used like pyrogallol in skin diseases. Applied externally
Gallanol (Gallic Acid Anilide, Gallinol, Gallanilide), $C_6H_5NH.CO.C_6H_2(OH)_3$	Prepared by boiling tannic acid with aniline. In grayish scales or powder, having a bitter taste, soluble in water, alcohol, and ether; very astringent. Used in skin diseases, in 3 to 20 per cent. ointments, and as a dusting powder when mixed with talc
Hepatica Liverwort	The leaves of *H. triloba*, found in North America. It contains tannin, mucilage, etc.
Heuchera Alum root	The root of *H. americana*, found in the United States. It contains about 20 per cent. of tannin
Hieraceum Hawkweed	From different species of *Hieraceum*, found in North America. It contains tannin
Hippocastanum Horsechestnut Bark	The bark of *Æsculus Hippocastanum*, grown in North America. It contains tannin and various other principles
Ilex Paraguayensis Maté, Paraguay Tea	The leaves of *I. paraguayensis*, grown in Brazil. It contains tannin and 10 to 15 per cent. of caffeine, etc.
Monesia Monesia	From *Chrysophyllum glycyphlœum*, found in Brazil. A vegetable extract, alterative, and astringent. Dose, from two to ten grains (0.13 to 0.65 Gm.) every hour or two
Myrobalanus Myrobalans	From different species of *Terminalia*, grown in Southern Asia. It contains about 45 per cent. of gallo-tannic acid
Nymphæa Water Lily	The rhizome of *N. odorata*, found in the United States. It contains tannin and mucilage
Potentilla Cinquefoil	From *P. canadensis*, found in North America. It contains tannin
Pulmonaria Lungwort	From *P. officinalis*, grown in Europe. It contains tannin
Quercus Tinctoria Black Oak Bark	From *Q. coccinea*, var. *tinctoria*, grown in the United States. It contains tannin, etc.
Rhus Aromatica Sweet Sumach	From *R. aromatica*. It contains tannin, coloring matter, gum resin, etc.
Rosa Centifolia Pale Rose. U. S. P. 1890	The petals of *Rosa centifolia* Linné (Fam. *Rosaceæ*). It contains tannin, volatile oil, sugar, etc. Used as a flavor
Saligallol (Pyrogallol Disalicylate)	A resinous solid, sold in the form of a 33 per cent. solution in acetone. Used in skin diseases, and as a vehicle for other dermic preparations. It is applied externally in the form of a 2 to 15 per cent. solution
Spiræa Hardhack	From *S. tomentosa*, found in North America. It contains tannin and bitter principle
Statice Marsh Rosemary	The root of *S. Limonium*, grown in Europe. It contains tannin and volatile oil
Tannalbin (Exsiccated Tannin Albuminate)	A compound of tannin and albumin in the form of a red-brown powder; tasteless and odorless. It contains about 50 per cent. of tannic acid. Used as an intestinal astringent, in doses of three to ten grains (0.2 to 0.65 Gm.)
Tannigen (Diacetyl Tannin), $C_{14}H_8(COCH_3)_2O_9$	An acetic ester of tannic acid. A yellowish, odorless, and tasteless hygroscopic powder; insoluble in water, very soluble in alcohol. An intestinal astringent in chronic diarrhœa, in doses of five to fifteen grains (0.32 to 1 Gm.)
Tannoform (Methylene-ditannin, Tannin-formaldehyde), $CH_2(C_{14}H_9O_9)_2$	Obtained by adding formaldehyde to an aqueous solution of tannic acid and precipitating with hydrochloric acid. A reddish-brown powder insoluble in water. Used as a dusting powder, as a drying antiseptic, and in intestinal disorders. Dose, four to eight grains (0.25 to 0.5 Gm)
Tormentilla Tormentil	From *T. erecta*, grown in Europe. It contains about 20 per cent. of tannin

QUESTIONS ON DRUGS CONTAINING GLUCOSIDES OR NEUTRAL PRINCIPLES, WITH THEIR PREPARATIONS

What are glucosides? (See page 1259.)
If salicin is boiled with sulphuric acid, what does it yield?
Explain the reaction which takes place.
How may glucosides be split into glucose and the derived product?
How do these principles act?
How are glucosides usually found?
Gentian—What is the Latin name? What is its source?
How is it officially described?
What does gentian contain?
Into what does the glucoside gentiopicrin split when heated with dilute acids?
What effect is produced by ferric salts upon preparations of gentian?
To what is this reaction due?
How may gentian preparations be prevented from discoloring when mixed with ferric salts?
What are the medicinal properties of gentian?
Give the dose. Name the more important preparations of it which are official.
Calumba—What are its synonyms?
What is its source? Give the official description. To what does it owe its virtues?
What other constituents are present?
For what is it used? What are the official preparations?
Quassia—What is its synonym? Give the official definition and description. What are the differences between the Jamaica and Surinam quassia?
What are its constituents?
To what does it owe its bitterness?
What are its properties? What are the official preparations?
Salicin—What is the Latin name? What is salicin?
How is it made? Describe appearance, odor, taste, chemical reaction, and solubility.
Give tests for identity and purity.
For what is it used medicinally? What is the dose?
Taraxacum—What is its synonym? What is its source?
Give the official description. What are its constituents?
To what does it owe its bitterness? For what is it used medicinally? Give the dose.
What are the official preparations?
Squill—What is the Latin title? What is its source? How may it be standardized? Give the official description. What principles does squill contain?
What liquids are suitable for extracting its active principles? What are its properties?
What are the official preparations?
Digitalis—What is its synonym? Give the P. I. title. What is its definition? How may it be standardized? Give the official description.
Name the important constituents.
Give the dose of each of the commercial forms of digitalis glucosides.
What are the medicinal properties of digitalis? Give the dose. What are its official preparations?
Strophanthus—Give the official definition and description. How may it be standardized? What effect does concentrated sulphuric acid have upon the crushed or cut seeds?
What principles does it contain? Why is the drug percolated with benzin in making the official tincture? For what is it used medicinally?
Give the dose. What preparation is official?
Strophanthin—Give Latin title and official definition. How may it be prepared?
Give description, taste, chemical reaction, solubility, and tests for identity and purity.
What is the dose and medicinal use?
Santonin—What is the Latin name? What is santonin?
How may it be made? Does it combine with alkalies?
What action do acids have upon these solutions?
Why should not the soluble compounds of santonin be used in medicine?
Give the description, odor, taste, chemical reaction, solubility, and tests for identity and purity.
For what is it used medicinally? What is the dose?

Adonis—What is the synonym? Give definition and description.
What are its constituents? Give its uses and dose.
Aletris—What are its synonyms? What is its source?
Name the constituents. Describe its appearance, odor, and taste.
Name its N. F. preparations, the uses and dose.
Brayera—What are the synonyms?
Give the definition. What constituents are present?
Name its N. F. preparation and the uses and dose.
Caulophyllum—Give the synonyms. How is it defined?
Name the constituents. Describe the drug. Give the uses and dose.
Centaury—What is the Latin title?
Give definition and description. What are the constituents?
Give uses and dose.
Chionanthus—What is the synonym? What is its source?
Describe the drug. For what is it used?
Chirata—What is its source? Give the official description.
What principles does it contain?
What are its uses? What is the official preparation?
Cocillana—Give definition and description.
What are the constituents? Name the N. F. preparation.
What are its uses and the dose?
Condurango—How is it defined? What are its constituents?
Describe the drug. What preparation is official? Give uses and dose.
Convallaria flowers—Give the synonym.
How is it defined and described?
Give the N. F. preparation and the uses and dose.
Convallaria root—Give the synonym.
What is its source? Name the constituents.
Describe the drug. Name its preparation, uses, and dose.
Cornus—What is the synonym? What is its source?
What constituents are present? Describe the drug. What preparation is official? Give its uses and dose.
Crocus—Name the synonym. How is it defined and described?
What constituents are present? What are its uses?
Coltsfoot—Give the Latin title and synonyms.
What is its source? Describe the drug.
What are its uses and the dose?
White ash bark—What is its source? Name the constituents. Give its uses and dose.
Helonias—What is its synonym? Give the definition and description.
What are its uses and the dose?
Cottonroot bark—What kind of cottonroot bark is official?
What is its source? What constituents are present?
Describe the drug. What are its uses? Why is the fresh bark used?
Hydrangea—Give the synonym.
How is it defined? Name the constituents. Describe the drug.
What are its uses and dose?
Melilot—Name the synonyms.
Give the definition and description.
What is its N. F. preparation? What are its uses?
Phytolacca—Give the synonym. How is it defined? What are the constituents.
Describe the drug. What are its uses and dose?
Verbena—What is the synonym?
Give its definition and description.
What are its constituents?
Name its N. F. preparation. What are its uses and dose?
Lappa—What is its synonym? What is its source? Describe this root.
What does it contain? What are its properties?
Mention the official preparation.
Menyanthes—What is the synonym?
Give its official definition and description.
What are the constituents? Give its uses ana dose.
Trifolium—What is the synonym?
Give its definition and description.
What are the constituents? What are its uses and the dose?
Red Saunders—Give the Latin title.
What is the definition and description?

Name the constituents. What are its uses? Name the official preparations into which it enters.
Sarsaparilla—What is its source? How is it officially described?
What glucoside does it contain?
Into what does this glucoside split when boiled with dilute acids?
What are its other constituents?
What are good solvents? What are its properties?
What are its official preparations?
Senega—What is its source? Name the synonyms. How is it officially described?
What does it contain? What are good solvents?
Why are preparations of senega apt to gelatinize?
How may this be obviated?
What are its properties?
What are its official preparations?
Quillaja—What is the synonym?
Give its source. What are the constituents?
Describe the drug. What are its uses?
Senna—What is its source? What is the difference between Alexandria and India senna? What does it contain?
Upon what principles does its cathartic action chiefly depend?
What was formerly believed to be the chief purgative principle?
Under the influence of dilute acids and heat, into what does cathartic acid split?
Are the purgative principles soluble in strong alcohol?
What portions are soluble?
What are good solvents for the purgative principles?
What is the dose of senna given in infusion?
What are its official preparations?
Rhubarb—What is the Latin official name? What is its source? How is it officially described?
What effect do alkalies have upon powdered rhubarb?
Name the principles which are present in rhubarb. Which of these are resins?
To what are the astringent properties of rhubarb due?
What other ingredient is present?
Upon what do the medicinal properties of rhubarb depend? What is the dose?
What are the more important official preparations?
Chrysarobin—What is the Latin name? What is chrysarobin?
Give the description, odor, taste, specific gravity, solubilities, and tests for identity. What are the objections to its use?
What are its properties and uses? What is its official preparation?
Gamboge—What is the Latin name? What is its source? How is it officially described?
What does it contain?
What effect have alkaline solutions upon the resin? What is its medicinal action?
In which official preparation is it an ingredient?
What is the dose?
Jalap—What is its source?
What percentage of total resin should be present?
How is it officially described?
What glucoside does it contain? What other constituents?
Upon what does the value of jalap depend?
How may its efficiency be tested? Describe the details of this assay. For what is it used medicinally? What is the dose?
What are the official preparations?
Scammony root—How is it defined?
What is the important constituent and how much should be present? What are its uses and dose?
What are its official preparations?
Podophyllum—What are its synonyms? What is its source? What is the U. S. P. standard? How is it officially described?
What does it contain? What is a good solvent? What is the use and dose?
What are the official preparations?
Cascara sagrada—What was the former official title?
Give the official description and definition. What are its active constituents?
For what is it used medicinally? Give the dose.
What are the official preparations?

Frangula—What is the synonym? Give the official description and definition.
What two glucosides does it contain? What other constituents?
What are its properties when fresh and when old?
What is the dose? What are the official preparations?
Aloes—Name the varieties of aloes included under this title. What is aloes? Give the several sources.
What does aloes contain?
What variety of aloin is present in Socotrine aloes?
How may this be distinguished from barbaloin and from nataloin?
What other principle is present in aloes and aloin? Name other cathartic drugs containing this principle. How do they produce this cathartic action?
Give official description, odor, taste, and tests for identity. How may the presence of gum and inorganic impurities be detected?
What is the dose? What are the more important official preparations?
Aloin—What is this substance? How is it prepared?
Give the official description, odor, taste, chemical reaction, solubility, and tests for identity. Name its N. F. preparations.
What are its medicinal properties?
Colocynth—What are its synonyms? What is its definition? How is it officially described? What glucosides does it contain?
Into what does this glucoside split under the action of diluted acids?
Are the seeds valuable? What is the dose? What are the official preparations?
Elaterin—Give the Latin name. What is elaterin?
How may it be prepared? What is elaterium, and how is it obtained?
What is the yield of elaterium from the cucumber?
How is commercial elaterium usually made? Describe appearance, odor, taste, chemical reaction, and solubility.
Give tests for identity. How may the absence of alkaloids be determined?
For what is it used medicinally? What is the dose?
What is the official preparation?
Bryonia—What is the synonym?
Give the definition and description.
What are its constituents?
What preparation is official?
Name its uses and the dose.
Cassia fistula—Give the synonym.
How is it defined and described?
What constituents are present?
Name its preparation, uses, and dose.
Euonymus—What is its synonym? What is its source? How is it officially described?
What does it contain? What is the dose? Name its official preparations. What precautions are necessary in administering it?
Fig—What is the Latin title, and definition?
Name the constituents, preparations, and uses.
Leptandra—What is the synonym? What is its source? How is it officially described?
What does it contain? What is the active principle?
Is it identical with the eclectic preparation leptandrin?
What are the properties of true leptandrin?
For what is leptranda used medicinally? What is the dose? What are the official preparations?
Prune—How is it defined and described?
Name the constituents, preparation, and uses.
Rhamnus cathartica—What are the synonyms?
What is this drug? Name its constituents.
Describe its appearance, odor, and taste.
What are its uses and the dose?
Nutgall—What is the Latin name? Give the synonyms. What are nutgalls? How are they officially described?
What do they contain? What are its uses and the dose? What are its official preparations?
Tannic acid—What is the Latin official name? What are the synonyms? How may it be prepared?

Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity. How may the following impurities be detected?—Gum or dextrin; resinous substances.
What are its uses and the dose? What form of liquid preparation is valuable? What are its official preparations?
Gallic acid—What is the Latin official name? What is gallic acid? What was the former official process for preparing it?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity. How may the absence of tannic acid be determined?
What are its uses and the dose?
Pyrogallol—Give the synonym. What is this substance chemically? How may it be obtained?
Give the official description, odor, taste, chemical reaction, solubility, and tests for identity.
What is its use in medicine? What is its use in the arts?
Gambir—What drug does this replace and why? What is its synonym?
What is the official definition? Give the official description.
What peculiar tannin is present? Give its characteristics. What other principles are present?
Why do its liquid preparations frequently gelatinize? What are its uses and the dose?
What are its official preparations?
Kino—What is it? Describe its appearance and characteristics. What does it contain?
Why do its liquid preparations frequently gelatinize? What is its medicinal use?
What is the dose?
What is its official preparation?
Red rose—What is the Latin official name? What is its source? What is the official description?
What does it contain?
What effect does sulphuric acid have upon the coloring matter?
For what is the infusion used?
What are its medicinal properties? What are its official preparations?
Castanea—Give the synonym. How is it defined and described? What are its constituents? Give the uses and dose.
Chimaphila—What is its synonym? What is its source? How is it officially described? What does it contain?
What are its uses and the dose? What is its official preparation?
Geranium—What is its synonym? How is it defined and how described? What does it contain?
What is its medicinal use?
What is the dose? What are its official preparations?
Hematoxylon—What is its synonym? What is its source? How is it officially described?
What does it contain?
What effect do alkalies have upon hematoxylon?
What are its medicinal properties? What is the dose?
What is its official preparation?
Hamamelis leaves—What is the Latin title? What is its synonym? How is it defined and described?
For what is it used medicinally? Give the official preparation.
Krameria—What is its synonym? What is its source?
Describe the difference between the several official varieties of krameria.
What does it contain? What is the dose?
What are its official preparations?
White oak—What is the Latin title? Give the official definition and description.
What does it contain?
For what is it used medicinally? Give the dose. Name the official preparation.
Rubus—What is its synonym? What is its source? How is it officially described?
To what does it owe its virtues? What is the dose?
What are its official preparations?
Rumex—What are its synonyms? Give its definition and description.
What are its constituents? Give its uses and the dose.
Uva ursi—What is its synonym? What is its source?
What does it contain? What is the dose? What are its official preparations?

CHAPTER LX

ALKALOIDS

THE alkaloids are unquestionably the most important of all the organic compounds which are of interest to the pharmacist, the most active and potent remedies that he dispenses belonging to this class of principles.

Chemically, many of the vegetable alkaloids are closely related to pyridine, quinoline, and similar bodies, and this fact, established by Königs—and the successful synthesis of some of the alkaloids starting from a pyridine base—has led chemists to endeavor to base a classification upon it. Alkaloids possess many properties which show their similarity to ammonia. They are mostly composed of carbon, hydrogen, nitrogen, and oxygen; in some oxygen is absent. Alkaloids are obtained from both the vegetable and the animal kingdom, although the term *leucomaines* is the term usually applied to basic principles found in living animal tissue, and *ptomaines* for the products of animal decomposition. These are sometimes called cadaveric alkaloids. They are found in nearly all the organs of plants, in roots, barks, stems, leaves, petals, seeds, etc. The distinctive features of alkaloids are as follows:

1. They all contain nitrogen. The non-volatile alkaloids are mostly solids, the volatile alkaloids are chiefly liquids.
2. Alkaloids restore the color of reddened litmus. They unite with acids to form salts, like the derived ammonias, and they are precipitated from their saline solutions upon the addition of alkalies.
3. They are generally the active principles of the plants in which they reside, and are mostly very poisonous or energetic remedies, having a bitter, acrid, or pungent taste.
4. They are mostly crystallizable and colorless, although some are amorphous, a few liquid, and several are distinctly colored; they are insoluble in water, but are soluble in alcohol, chloroform, petroleum benzin, benzene, and some in ether. Their salts, on the other hand, are mostly soluble in water, less so in alcohol, but insoluble in chloroform, ether, petroleum benzin, and benzene.
5. Alkaloids are mostly precipitated by one or more of the following reagents, usually forming definite chemical compounds: mercuric-potassium iodide (*Mayer's reagent*), potassium-cadmium iodide (*Marme's reagent*), potassium-bismuth iodide (*Dragendorff's reagent*), phosphotungstic acid (*Sonnenschein's reagent*), phosphomolybdic acid (*Wagner's reagent*), gold chloride, tannic acid, and picric acid.

The alkaloids will be considered in the order of their relative importance, but they are often classified in accordance with their chemical derivation as follows:

Pyridine Group.—Piperidine, piperine, coniine, pilocarpine, nicotine, and sparteine.

Tropine Group.—Tropine, atropine, homatropine, scopolamine, hyoscine, hyoscyamine, cocaine, and beta-eucaine.

Quinoline Group.—Quinine, quinidine, cinchonine, cinchonidine, phenylcinchoninic acid, strychnine, and veratrine.

Isoquinoline Group.—Hydrastine and hydrastinine.

Phenanthrene Group.—Morphine, diacetyl-morphine, ethyl-morphine, apomorphine, and codeine.

Other alkaloids remain unclassified chemically, such as physostigmine, aconitine, colchicine, pelletierine, emetine, cornutine, gelsemine, etc.

The official nomenclature adopted for alkaloids requires that the last syllable shall terminate in *ine:* thus, quinine, morphine, strychnine. The Latin termination is *ina:* as, quinina, morphina, etc. The names of neutral principles and glucosides end in *in:* as salicin, santonin, gelatin.

Alkaloidal Assay.—Most drugs containing alkaloids and their preparations may be standardized by determining the per cent. of alkaloid present. Assay processes have been devised for the more important and are outlined in the test under each drug. The general principles involved are explained in Chapter LXII, in the U. S. P. Test, No. 15.

OPIUM. U. S. Opium

The air-dried, milky exudation obtained by incising the unripe capsules of *Papaver somniferum* Linné and its variety *album* De Candolle (Fam. *Papaveraceæ*), and yielding, in its normal, moist, condition, not less than 9.5 per cent. of anhydrous morphine.

Official Description.—In more or less rounded, mostly somewhat flattened masses of variable size, but usually about 8 to 15 cm. in diameter; externally grayish-brown, covered with fragments of poppy leaves and at times with some fruits of a species of rumex adhering from the packing; more or less plastic when fresh, becoming hard and brittle on keeping; internally dark brown, interspersed with lighter areas, somewhat lustrous.

Odor and Taste.—Odor characteristic, narcotic; taste bitter, characteristic.

For a description of the powder see *Opii Pulvis.*

Assay.—Introduce 8 Gm. of Opium, which if fresh should be in very small pieces, and if dry in fine powder, into an Erlenmeyer flask having a capacity of about 250 mils, add 80 mils of distilled water, stopper the flask, and agitate it every ten minutes (or continuously in a mechanical shaker) during three hours. Then pour the contents as evenly as possible upon a wetted filter having a diameter of not over 12 cm., and, when the liquid has drained off, wash the residue with distilled water, carefully dropped upon the edges of the filter and its contents, until 120 mils of filtrate have been obtained. Carefully transfer the moist Opium to a mortar by means of a spatula, and rub to a smooth paste, then rinse into the original flask with 50 mils of distilled water, agitate it thoroughly and return the whole to the filter. When the liquid has drained off, wash the residue with 75 mils of distilled water. Evaporate the mixed filtrates and washings on a water bath to about 40 Gm. Transfer the extract to a 50-mil graduated flask and wash the evaporating dish with sufficient distilled water to make the entire volume measure exactly 50 mils when cooled to room temperature. Place in a small mortar 4 Gm. of freshly slaked lime (see Reagents, Chapter LXII), add about 10 mils of the opium extract and rub to a smooth paste, then add the remainder of the extract and rinse the flask with exactly 10 mils of distilled water, adding the rinsing to the mortar, and stir frequently during fifteen minutes, avoiding unnecessary loss by evaporation. Filter through a dry filter, about 10 cm. in diameter, and transfer exactly 30 mils of the filtrate, representing *four grammes* of Opium, to an Erlenmeyer flask of suitable capacity. To this add 2 mils of alcohol and 15 mils of ether, and, after shaking the mixture, add 1 Gm. of ammonium chloride, stopper the flask and shake it frequently during half an hour, then set aside in a cool place for twelve hours or over night. Remove the stopper and brush any adhering crystals back into the flask. Decant the ethereal layer into a small funnel, the neck of which has been previously closed with a pledget of purified cotton. Rinse the flask and contents with 15 mils of ether, and, when the ether has passed through, wash the funnel and cotton with a small quantity of ether, and then pour the aqueous liquid into the funnel without trying to remove the crystals. Wash the crystals in the flask and the contents of the funnel with distilled water, previously saturated with morphine, until the washings are colorless. Then add a few drops of distilled water to replace the morphinated water. Incline the edge of the funnel over the mouth of the flask and by means of a glass rod carefully transfer the cotton with adhering crystals to the flask. Insert the funnel into the neck of the flask and wash the funnel with 20 mils of tenth-normal sulphuric acid V.S., followed by 10 mils of distilled water, applied drop by drop around the edge of the funnel. Remove the funnel, replace the cork, warm gently, and agitate until the crystals are dissolved. Rinse the cork with distilled water and titrate the excess of acid with fiftieth-normal potassium hydroxide V.S., cochineal T.S. being used as indicator. Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 0.028516 Gm. of anhydrous morphine.

U. S. P. Preparations.—Extractum Opii; Mistura Glycyrrhizæ Composita (from Camphorated Tincture); Opii Pulvis; Opium Deodoratum; Opium Granulatum; Pulvis Ipecacuanhæ et Opii; Tinctura Opii; Tinctura Opii Camphorata; Tinctura Opii Deodorati.

N. F. Preparations.—Acetum Opii; Linimentum Opii Compositum; Lotio Plumbi et Opii; Mistura Camphoræ Acida; Mistura Carminativa; Mistura Magnesiæ, Asafœtidæ et Opii; Mistura Opii et Chloroformi Composita; Mistura Opii et Rhei Composita; Mistura Opii et Sassafras; Mistura Pectoralis, Stokes; Pilulæ Opii et Camphoræ; Pilulæ Opii et Plumbi; Pulvis Cretæ et Opii Aromaticus; Pulvis Kino et Opii Compositus; Syrupus Ipecacuanhæ et Opii (from Tincture); Tinctura Ipecacuanhæ et Opii (from Tincture of Deodorized Opium); Tinctura Kino et Opii Composita (from Tincture); Tinctura Opii Crocata; Tinctura Pectoralis (from Tincture).

OPII PULVIS. U. S. Powdered Opium

[Opii Pulv.—Opii pulvis, P. I.]

Opium dried at a temperature not exceeding 70° C. (158° F.), reduced to a very fine powder, and yielding not less than 10 per cent. nor more than 10.5 per cent. of anhydrous morphine. Powdered Opium of a higher morphine percentage may be brought within the required limits by admixture with powdered opium of a lower percentage, or with some inert diluent. Preserve it in well-closed containers.

Official Description.—Powdered Opium is light brown; consisting chiefly of yellowish-brown to brownish-red, more or less irregular and granular fragments, varying from 0.015 to 0.15 mm. in diameter; a few fragments of strongly lignified, thick-walled, 4- to 5-sided or narrowly elongated, epidermal cells of the poppy capsule; and very few fragments of tissues of poppy leaves, poppy capsules, and rumex fruits.

Assay.—Proceed as directed under *Opium*.

U. S. P. Preparations.—Opium Deodoratum; Pulvis Ipecacuanhæ et Opii; Tinctura Opii Camphorata.

N. F. Preparations.—Pilulæ Opii et Camphoræ; Pilulæ Opii et Plumbi; Pulvis Cretæ et Opii Aromaticus; Pulvis Kino et Opii Compositus.

OPIUM GRANULATUM. U. S. Granulated Opium

[Opium Gran.]

Opium dried at a temperature not exceeding 70° C. (158° F.), reduced to a coarse (No. 8 to No. 20) powder and yielding not less than 10 per cent. nor more than 10.5 per cent. of anhydrous morphine. Granulated Opium of a higher morphine percentage may be brought within the required limits of strength by admixture with granulated opium of a lower percentage, or with some inert diluent. Preserve it in well-closed containers.

Assay.—Proceed as directed under *Opium*.

U. S. P. Preparations.—Tinctura Opii; Tinctura Opii Deodorati.

N. F. Preparations.—Acetum Opii; Tinctura Opii Crocata.

OPIUM DEODORATUM. U. S. Deodorized Opium
[Opium Deod.]

Deodorized Opium yields not less than 10 per cent. nor more than 10.5 per cent. of anhydrous morphine. Deodorized Opium of a higher morphine percentage may be brought within the required limits by admixture with deodorized opium of a lower percentage or with some inert diluent. Preserve it in well-closed containers.

	Metric	Old form
***Powdered Opium**	**500 Gm.**	**8 oz. av.**
Purified Petroleum Benzin, a sufficient quantity.		

Macerate the powdered opium for twenty-four hours in a wide-mouthed, well-closed bottle with sufficient purified petroleum benzin to cover it completely, shaking the mixture occasionally. Then decant the clear benzin layer as closely as possible and repeat the maceration for twenty-four hours with another portion of purified petroleum benzin. Again decant the clear benzin layer and transfer the remaining contents of the bottle to a plain filter. Closely cover the funnel, allow the mixture to drain and then slowly percolate the residue with purified petroleum benzin until the latter passes through without color. Remove the filter containing the Opium from the funnel, expose the powder to the open air, so that it may dry thoroughly, and add sufficient sugar of milk to restore the original weight. Care should be used to guard against the danger due to the inflammability of the benzin. Granulated opium may also be deodorized in the manner directed above.

Assay.—Proceed as directed under *Opium.*

Opium in coarser powder may be deodorized in the same manner as directed above.

Alkaloids, etc.—Opium owes its value to the narcotic alkaloids present in it. More than twenty alkaloids have been proved to exist in various kinds of opium, and several more have been announced, but their existence has not been certainly confirmed. Two acids are found in opium combined with the alkaloids—*i.e.,* meconic and lactic acids; there are also present *meconin,* $C_{10}H_{10}O_4$, meconoiosin, $C_8H_{10}O_2$, both neutral principles, pectin, glucose, mucilage, caoutchouc, wax, and odorous, fatty, and coloring matters. *Meconic acid* is colored red by ferric salts, the color not being discharged by solution of mercuric chloride. A solution of potassium sulphocyanate is colored in a similar manner, but it is rendered colorless by solution of mercuric chloride. The alkaloids are as follows:

Morphine, $C_{17}H_{19}O_3N.H_2O$. The chief principle, and the first alkaloid discovered (see separate article, page 1316).

Codeine, $C_{18}H_{21}O_3N.H_2O$. An important narcotic alkaloid (see page 1319).

Narcotine, $C_{22}H_{23}O_7N$. Derosne, in 1803, obtained from opium a substance, "opium salt," which was a mixture of narcotine and morphine. He erroneously supposed it to be the narcotic principle, and did not recognize its alkaloidal character. Narcotine was isolated by Robiquet in 1817. It is white, tasteless, and inodorous, and crystallizes in silky, flexible needles, usually larger than the crystals of morphine, fusible at 115.5° C. (240° F.), and volatilizable at 154.4° C. (310° F.), insoluble in cold water, soluble in 400 parts of boiling water, in 100 parts of cold alcohol, and in 24 parts of boiling alcohol, which deposits it upon cooling, and very soluble in ether. It is colored red by a mixture of sulphuric and nitric acids. It is *not narcotic,* but is said to be antiperiodic.

Thebaine (Paramorphine), $C_{19}H_{21}O_3N$, is white, crystallizable, of an acrid and styptic rather than bitter taste, fusible at about 193° C. (379.4° F.), scarcely soluble in water, very soluble in alcohol and ether when cold, and still more so when heated. Alkalies precipitate it from its acid solutions, and, unless in very concentrated solution, do not dissolve it when added in excess. Unlike morphine, it is not reddened by nitric acid, nor does it become blue with solutions of ferric salts. It is colored red by a mixture of sulphuric and nitric acids. It is not narcotic, but in its effects on the system is closely analogous to strychnine, producing tetanic spasms in the dose of a grain (0.065 Gm.).

Papaverine, $C_{20}H_{21}O_4N$, is crystallizable in needles, fusible at 147° C. (296.6° F.), and volatilizable at 154.4° C. (310° F.). It is insoluble in water, very sparingly soluble in cold alcohol or ether, more soluble in these liquids boiling hot, and deposited by them on cooling; soluble in benzene and chloroform. It is colored dark blue by sulphuric acid, changing to green if a crystal of potassium nitrate is added to it. It is narcotic.

Narceine, $C_{23}H_{29}O_9N.3H_2O$, is in white, silky crystals, inodorous, of a bitter taste, fusible at 170° C. (338° F.), and volatilizable at 215.5° C. (420° F.), soluble in 375 parts of cold and 220 of boiling water, soluble also in alcohol, and insoluble in ether. It forms a bluish compound with a little iodine, the color of which is destroyed by heat and the alkalies. It is rendered blue by the action of mineral acids so far diluted as not to decompose it; but, unlike morphine, it does not become blue by the action of ferric salts, nor red by that of nitric acid. Narceine is narcotic, and may be given in doses of one-third to one-half of a grain (0.02 to 0.032 Gm.).

Hydrocotarnine, $C_{12}H_{15}O_3N$, is soluble in alcohol, acetone, chloroform, petroleum benzin, and ether. It melts at 55° C. (131° F.), and loses at a somewhat greater heat the molecule of water with which it crystallizes. Sulphuric acid dissolves it, coloring it yellow in the cold, and crimson red if heated. Nitric acid colors it yellow; ferric chloride does not affect its color.

Pseudomorphine, $C_{34}H_{36}O_6N_2$, possesses two properties of morphine. It dissolves in concentrated nitric acid with an intense orange-red color, and in solution of ferric chloride with a blue color.

Cryptopine, $C_{21}H_{23}O_5N$, produces a blue color with sulphuric acid; it is but slightly soluble in water or alcohol. It is narcotic.

Protopine, $C_{20}H_{19}O_5N$, is insoluble in water, soluble in alcohol and chloroform.

Laudanine, $C_{20}H_{25}O_4N$. Colored red by sulphuric acid, a reddish violet when heated. A strong tetanic poison.

Codamine, $C_{20}H_{25}O_4N$. Isomeric with laudanine; colored green with nitric acid and ferric chloride.

Rhœadine, $C_{21}H_{21}O_6N$. Nearly insoluble in water, alcohol, ether, petroleum benzin, and chloroform; with sulphuric acid it turns a purple color.

Meconidine, $C_{21}H_{23}O_4N$. Amorphous; easily soluble in alcohol, ether, benzene, and chloroform; colored olive-green by sulphuric acid, orange-red by nitric acid.

Laudanosine, $C_{21}H_{27}O_4N$. Produces rose color with sulphuric acid, violet when heated; soluble in ether.

Lanthopine, $C_{23}H_{25}O_4N$. Easily soluble in chloroform, sparingly soluble in alcohol, ether, or benzene.

Gnoscopine, $C_{34}H_{36}O_{11}N_2$. Crystallizable; soluble in chloroform, carbon disulphide, and benzene, but not in ether.

Deuteropine, $C_{20}H_{21}O_5N$. Similar to cryptopine.

Oxynarcotine, $C_{22}H_{23}O_8N$. Nearly insoluble in water, alcohol, chloroform, and benzene, but soluble in alkaline solutions.

Uses.—Opium is narcotic, sedative, and antispasmodic. The dose of powdered opium is one grain (0.065 Gm.). The official preparations are listed above.

The use and sale of opium, its alkaloids and derivatives and other narcotics and habit-forming drugs, are subject to rigid government regulation under what is called the *Harrison Act.* Under its provisions those who desire to sell or dispense the prohibited drugs must register and pay a special tax. The administration of the law is under the control of the Internal Revenue Department. The listed narcotics may be bought only upon a special order blank, a copy of which must be kept by the purchaser, and held subject to inspection by government officials. These drugs may be dispensed on physicians' prescriptions only under well-defined conditions, the prescription being an original one, signed by the physician, and not subject to renewal, and such prescriptions shall not be for known habitués. The druggist must keep a record of the sale in a special registry. Certain exemptions are allowed, provided advantage is not taken of the exemption to defeat the purpose of the Act. The exemptions are official or proprietary preparations or remedies (but not compounded prescriptions) which do not contain more than two grains of opium, or more than one-fourth of a grain of morphine, or more than one-eighth of a grain of heroin, or more than one grain of codeine or their salts, in one fluidounce or avoirdupois ounce; or liniments, ointments or other preparations for external use. No preparations containing cocaine are exempt. The Act and its regulations may be obtained from the Internal Revenue Department, Washington, D. C.

MORPHINA. U. S. Morphine

An alkaloid [$C_{17}H_{19}O_3N + H_2O = 303.18$] obtained from opium. Preserve it in well-closed containers, protected from light.

Morphine was the first alkaloid to be discovered. The credit of its isolation belongs to Sertürner, an apothecary of Eimbeck, Germany, who discovered, in 1806, a crystalline principle in opium, and announced its basic character and that it existed in combination with a special acid. He published the results of his further investigations in 1817, when he stated that it was a vegetable alkali, and showed its similarity to ammonia; he named it *morphium*.

Preparation.—Morphine may be prepared by the former official process, as follows:

Take of opium, sliced, 12 oz. troy; ammonia water, 6 fl. oz.; animal charcoal, in fine powder, alcohol, distilled water, each, a sufficient quantity. Macerate the opium with 4 pints of distilled water for twenty-four hours, and, having worked it with the hand, again macerate for twenty-four hours, and strain. In like manner, macerate the residue twice successively with the same quantity of distilled water, and strain. Mix the infusions, evaporate to 6 pints, and filter; then add 5 pints of alcohol, and afterwards 3 fl. oz. of the ammonia water, previously mixed with 8 fl. oz. of alcohol. After twenty-four hours, pour in the remainder of the ammonia water, mixed, as before, with 8 fl. oz. of alcohol; and set the liquid aside for twenty-four hours that crystals may form. To purify these, boil them with 2 pints of alcohol until they are dissolved, filter the solution, while hot, through animal charcoal, and set it aside to crystallize.

In this process the infusions containing the morphine, in combination with meconic and lactic acids, are treated with alcohol and ammonia water. The former retains the coloring matter, caoutchouc, resins, etc., in solution, while the ammonia combines with the natural acids, the morphine being precipitated as an insoluble precipitate.

Official Description.—Occurs in colorless or white, shining, rhombic prisms, in fine needles, or as a crystalline powder; permanent in the air.

Odor and Reaction.—Odorless. A saturated aqueous solution of Morphine is alkaline to litmus.

Solubility.—One Gm. of Morphine dissolves in 3340 mils of water, 210 mils of alcohol, 1220 mils of chloroform, 6250 mils of ether, and in 100 mils of lime water, at 25° C. (77° F.), also in 1075 mils of boiling water and 98 mils of boiling alcohol: insoluble in benzene.

Tests for Identity.—One mil of sulphuric acid added to about 0.05 Gm. of Morphine produces either no color or at most only a red or yellow tint; on heating, a brown color is developed.

Sulphuric acid containing 0.005 Gm. of selenous acid in each mil gives with Morphine a blue color, changing to green and then to brown. (Codeine yields a green color, changing to blue, and afterwards to grass-green; narcotine gives a green color, changing to brown and then to cherry-red.)

Nitric acid produces with Morphine an orange-red color fading to yellow. Sulphuric acid containing 0.005 Gm. of molybdic acid in each mil gives a purple color, changing to blue. Sulphuric acid containing in each mil one drop of solution of formaldehyde yields an intense purple color.

Add a few drops of ferric chloride T.S. to a neutral solution of Morphine (1 in 100) made by the careful addition of diluted sulphuric acid; a blue color is produced, which is destroyed by acids, alcohol, or by heating.

Morphine solutions, when mixed with an aqueous solution of potassium ferricyanide containing a drop of ferric chloride T.S., yield deep blue solutions from which, after standing, a blue precipitate separates (difference from *codeine*).

Impurities and Tests for Impurities.—*Moisture.*—Morphine loses not more than 6.5 per cent. of its weight when dried to constant weight at 100° C. (212° F.).

No weighable ash remains on incinerating 0.5 Gm. of Morphine.

Meconic Acid or Meconates.—Dissolve about 0.1 Gm. of Morphine in 10 mils of diluted hydrochloric acid; no red coloration is produced by the addition of a few drops of ferric chloride T.S.

Ammonium Salts.—Warm about 0.2 Gm. of morphine with 4 mils of potassium hydroxide T.S.; the odor of the ammonia is not noticeable.

Foreign Alkaloids.—Dissolve 1 Gm. of Morphine in 10 mils of sodium hydroxide T.S., shake out the solution with three successive portions of 15, 10, and 10 mils of chloroform, passing the chloroform solutions through a small filter previously moistened with chloroform. Evaporate carefully the combined chloroform solutions to dryness on a water bath, dissolve the residue in 10 mils of fiftieth-normal sulphuric acid V.S., add a few drops of methyl red T.S. and titrate the excess of acid with fiftieth-normal potassium hydroxide V.S. Not less than 7.5 mils of the latter is required.

Uses.—Morphine is rarely used medicinally, its salts—the sulphate, acetate, hydrochloride, etc.—being preferred because of their solubility in water. The dose is one-eighth grain (0.008 Gm.).

MORPHINÆ HYDROCHLORIDUM. U. S. **Morphine Hydrochloride**

[**Morph. Hydrochl.**—MORPHINE CHLORIDE]

The hydrochloride [$C_{17}H_{19}O_3N.HCl + 3H_2O = 375.68$] of the alkaloid morphine. Preserve it in well-closed containers, protected from light.

Preparation.—This salt may be prepared by mixing morphine with distilled water and carefully adding hydrochloric acid, drop by drop, until the morphine is neutralized and dissolved. Evaporate the solution, on a water bath, to the consistence of a syrup and set it aside until it crystallizes. Lastly dry the mass at a gentle heat.

Official Description.—It occurs in white, silky, glistening needles or cubical masses, or as a white, crystalline powder; permanent in the air.

Odor and Reaction.—Odorless. Its aqueous solution (1 in 20) is neutral or slightly acid to litmus.

Solubility.—One Gm. of Morphine Hydrochloride dissolves in 17.5 mils of water and 52 mils of alcohol at 25° C. (77° F.), also in 0.5 mil of boiling water and 46 mils of alcohol at 60° C. (140° F.); soluble in glycerin; insoluble in chloroform or ether.

Tests for Identity.—Silver nitrate T.S., when added to an aqueous solution of the salt, produces a white precipitate insoluble in nitric acid.

Impurities and Tests for Impurities.—*Apomorphine.*—Add potassium carbonate T.S. to 5 mils of an aqueous solution of the salt (1 in 30); a white precipitate is produced, which does not become green on exposure to air nor yield a color to chloroform when shaken with it.

Moisture.—It loses not more than 15 per cent. of its weight when dried to constant weight at 100° C. (212° F.).

In all other respects the salt responds to the tests for identity and purity under *Morphina.*

N. F. Preparation.—Syrupus Morphinæ et Acaciæ.

Uses.—Morphine hydrochloride is used very largely in Great Britain as a narcotic and sedative. The dose is one-eighth to one-fourth of a grain (0.008 to 0.015 Gm.).

MORPHINÆ SULPHAS. U. S. **Morphine Sulphate**

[**Morph. Sulph.**]

The sulphate [$(C_{17}H_{19}O_3N)_2.H_2SO_4 + 5H_2O = 758.49$] of the alkaloid morphine. Preserve it in well-closed containers, protected from light.

Preparation.—This useful salt may be made by the former official process, as follows:

Take of morphine, in fine powder, 1 oz. troy; distilled water, 8 fl. oz.; diluted sulphuric acid, a sufficient quantity. Mix the morphine with the distilled water, then carefully drop in diluted sulphuric acid, constantly stirring until the morphine is neutralized and dissolved. Evaporate the solution, by means of a water bath, so that on cooling it may crystallize. Lastly, drain the crystals, and dry them on bibulous paper.

Official Description.—It occurs in white, feathery, acicular, silky crystals, or in cubical masses; permanent in the air.

Odor and Reaction.—Odorless. Its aqueous solution (1 in 20) is neutral or slightly acid to litmus.

Solubility.—One Gm. of Morphine Sulphate dissolves in 15.5 mils of water and 565 mils of alcohol at 25° C. (77° F.), also in 0.7 mil of water at 80° C. (176° F.), and 240 mils of alcohol at 60° C. (140° F.); insoluble in chloroform or ether.

Tests for Identity.—Barium chloride T.S. produces a white precipitate insoluble in hydrochloric acid when added to an aqueous solution of the salt.

Moisture.—Morphine Sulphate loses not more than 7.5 per cent. of its weight when dried for four hours at 100° C. (212° F.).

Impurities and Tests for Impurities.—In all other respects the salt responds to the tests for identity and purity under *Morphina.*

N. F. Preparations.—Mistura Chloroformi et Morphinæ Composita; Syrupus Pini Strobi Compositus cum Morphina.

Uses.—Morphine sulphate is much more largely employed in the United States than any other salt of morphine. The dose is one-eighth to one-fourth of a grain (0.008 to 0.015 Gm.). The *solution of morphine sulphate* formerly official was made by dissolving one grain of morphine sulphate in one fluidounce of distilled water. Although the solution is more stable than that of any other of the morphine salts in use, it will in time deteriorate, either through the presence of microscopic plants or from other causes, and hence it is not desirable to keep it on hand. This solution must not be confounded with *Magendie's solution*, which is *sixteen times as strong*—*i.e.*, sixteen grains in a fluidounce. This solution is often used hypodermically.

CODEINA. U. S. Codeine

[Codein.—METHYLMORPHINE]

An alkaloid [$C_{18}H_{21}O_3N + H_2O$ or $C_{17}H_{18}(CH_3)O_3N + H_2O = 317.19$] obtained from opium, or prepared from morphine by methylation. Preserve it in well-closed containers, protected from light.

Preparation.—When a solution of mixed morphine and codeine hydrochlorides is treated with ammonia, the former alkaloid is precipitated, and the codeine, remaining in solution, may be obtained by evaporation and crystallization. It may be purified by treating the crystals with hot ether, which dissolves them, and yields the codeine in colorless crystals on spontaneous evaporation.

Codeine is a substituted morphine, in which one of the hydroxyl atoms is replaced by methoxyl, OCH_3. It has been obtained synthetically by heating morphine with methyl iodide.

Codeine is remarkable for being, with the exception of colchicine, the most soluble alkaloid in use, there being no necessity for salifying it. Its salts are frequently used and are even more soluble. It is usually seen in larger crystals than any other alkaloid.

Official Description.—It occurs in colorless, translucent, rhombic prisms, or as a crystalline powder; slightly efflorescent in warm air.

Odor and Reaction.—Odorless. A saturated aqueous solution of Codeine is alkaline to litmus and is lævorotatory.

Solubility.—One Gm. of Codeine dissolves in 120 mils of water, 2 mils of alcohol, 0.5 mil of chloroform, and in 18 mils of ether at 25° C. (77° F.), also in 1.2 mils of alcohol at 60° C. (140° F.).

Tests for Identity.—Codeine, rendered anhydrous, melts between 154° and 156° C. (309.2–312.8° F.).

When heated in an insufficient amount of water for complete solution, it melts to oily drops, which crystallize on cooling.

Sulphuric acid containing 0.005 Gm. of selenous acid in each mil produces with Codeine a green color, changing rapidly to blue, then slowly back to grass-green.

About 0.01 Gm. of Codeine dissolves in 5 mils of sulphuric acid (free from nitrous compounds) without showing other than a transient, pinkish tint; on the addition of a drop of ferric chloride T.S., the solution becomes blue when warmed and changes to red on the further addition of a drop of nitric acid.

Impurities and Tests for Impurities.—When dried to constant weight at 80° C. (176° F.), Codeine loses not more than 6 per cent. of its weight. No weighable ash remains on incinerating 0.5 Gm. of Codeine.

Morphine.—Dissolve about 0.05 Gm. of potassium ferricyanide in 10 mils of distilled water, add 1 drop of ferric chloride T.S., and then 1 mil of a neutral or slightly acid aqueous solution of Codeine (1 in 100), made with the aid of sulphuric acid; no blue color is produced at once.

N. F. Preparation.—Elixir Terpini Hydratis et Codeinæ.

Uses.—Codeine is a sedative, in doses of one-fourth to one grain (0.015 to 0.065 Gm.).

CODEINÆ PHOSPHAS. U. S. Codeine Phosphate
[Codein. Phos.]

The phosphate [$C_{18}H_{21}O_3N.H_3PO_4 + 2H_2O$ or $C_{17}H_{18}(CH_3)O_3N.H_3PO_4 + 2H_2O = 433.27$] of the alkaloid codeine. It yields not less than 67 per cent. of anhydrous codeine ($C_{18}H_{21}O_3N$). Preserve it in well-closed containers, protected from light.

Preparation.—Codeine phosphate may be made by evaporating and crystallizing a solution of codeine in phosphoric acid.

Official Description.—It occurs in fine, white, needle-shaped crystals, or as a crystalline powder; very efflorescent.

Odor and Reaction.—Odorless. Its aqueous solution (1 in 20) is acid to litmus.

Solubility.—One Gm. of Codeine Phosphate dissolves in 2.3 mils of water, 325 mils of alcohol, 4500 mils of chloroform, and in 1875 mils of ether at 25° C. (77° F.); also in 0.5 mil of water at 80° C. (176° F.), and in 125 mils of boiling alcohol.

Tests for Identity.—Silver nitrate T.S. produces in an aqueous solution of the salt, previously neutralized with ammonia water, a yellow precipitate which is soluble in diluted nitric acid and in ammonia water.

Impurities and Tests for Impurities.—*Sulphates.*—Separate portions of 10 mils each of an aqueous solution of Codeine Phosphate (1 in 100), acidulated with nitric acid, are not rendered turbid at once on the addition of a few drops of barium chloride T.S. or

Chlorides.—Opalescent by a few drops of silver nitrate T.S.

Assay.—Dissolve about 0.5 Gm. of Codeine Phosphate, accurately weighed, in 10 mils of distilled water, add 10 mils of potassium hydroxide T.S. and shake the mixture with three successive portions of 15 mils each of chloroform, or a sufficient quantity to complete the extraction. The combined chloroform solutions, carefully evaporated to dryness on a water bath, yield, after drying to a constant weight at 110° C. (230° F.), not less than 67 per cent. of anhydrous codeine.

In other respects Codeine Phosphate responds to the tests of identity and purity under *Codeina*, omitting the melting point and ash test.

Uses.—Codeine phosphate is a valuable sedative, and is often preferred to any of the morphine salts. Dose, one-half grain (0.032 Gm.).

CODEINÆ SULPHAS. U. S. Codeine Sulphate
[Codein. Sulph.]

The sulphate [$(C_{18}H_{21}O_3N)_2.H_2SO_4 + 5H_2O$ or $(C_{17}H_{18}(CH_3)O_3N)_2.H_2SO_4 + 5H_2O = 786.52$] of the alkaloid codeine. Preserve it in well-closed containers, protected from light.

Preparation.—Codeine sulphate is made by evaporating a solution of codeine in diluted sulphuric acid.

Official Description.—It occurs in long, glistening, white, needle-shaped crystals or rhombic prisms, or as a crystalline powder; efflorescent in the air.

Odor and Reaction.—Odorless. Its aqueous solution (1 in 40) is neutral or not more than faintly acid to litmus.

Solubility.—One Gm. of Codeine Sulphate dissolves in 30 mils of water and in 1280 mils of alcohol at 25° C. (77° F.); also in 6.5 mils of water at 80° C. (176° F.) and in 440 mils of alcohol at 60° C. (140° F.); insoluble in chloroform or ether.

Test for Identity.—Barium chloride T.S. produces, in an aqueous solution of the salt, a white precipitate which is insoluble in hydrochloric acid.

Impurities and Tests for Impurities.—When dried to constant weight at 100° C. (212° F.), Codeine Sulphate loses not more than 12 per cent. of its weight.

In other respects the salt responds to the tests for identity and purity under *Codeina*, omitting the melting point.

N. F. Preparation.—Syrupus Codeinæ.

Uses.—Codeine sulphate is preferred by many practitioners to morphine sulphate. It is used as a sedative and narcotic. Dose, one-half grain (0.032 Gm.).

APOMORPHINÆ HYDROCHLORIDUM. U. S. Apomorphine Hydrochloride

[Apomorph. Hydrochl.—APOMORPHINE CHLORIDE]

The hydrochloride [$C_{17}H_{17}O_2NHCl + \frac{1}{2}H_2O = 312.62$] of an alkaloid prepared from morphine by the abstraction of one molecule of water. Preserve it, protected from light, in small, well-stoppered vials, which have been previously rinsed with diluted hydrochloric acid and dried.

Apomorphine Hydrochloride must be rejected if it imparts at once an emerald-green color to 100 parts of distilled water when shaken with it in a test tube.

Preparation.—It may be made by heating morphine in a closed tube with a great excess of hydrochloric acid for two or three hours to the temperature of 140° to 150° C. (284° to 302° F.). The contents of the tube are then dissolved in water, an excess of sodium bicarbonate added, and the precipitate exhausted with ether or chloroform. On the addition to the solution of a very small quantity of hydrochloric acid, crystals of apomorphine hydrochloride form. The process is one of dehydration—the morphine parting with one molecule of water, thus:

$$\underset{\text{Morphine}}{C_{17}H_{19}O_3N} + \underset{\text{Water}}{H_2O} = \underset{\text{Apomorphine}}{C_{17}H_{17}O_2N}$$

Official Description.—It occurs in minute, white or grayish-white, glistening, monoclinic prisms, acquiring a greenish tint upon exposure to light and air.

Odor and Reaction.—Odorless. Its saturated aqueous solution is neutral to litmus.

Solubility.—One Gm. of Apomorphine Hydrochloride dissolves in 50 mils of water and in 50 mils of alcohol at 25° C. (77° F.); also in 17 mils of water at 80° C. (176° F.); very slightly soluble in chloroform or ether.

Tests for Identity.—The salt loses its water of crystallization slowly over sulphuric acid and the anhydrous salt regains the water lost when exposed to the air.

The addition of a solution of sodium bicarbonate to an aqueous solution of the salt (1 in 100) produces a white or pale greenish-white precipitate, which rapidly becomes green on exposure to air and then dissolves in ether with a violet color and in chloroform with a violet-blue color. The salt dissolves in nitric acid with a dark purple color.

Silver nitrate T.S., added to an aqueous solution of the salt, produces a white precipitate, insoluble in nitric acid; the precipitate soon turns black by reduction to metallic silver, and is instantly reduced by the addition of ammonia water.

Impurities and Tests for Impurities.—No weighable ash remains on incinerating 0.2 Gm. of Apomorphine Hydrochloride.

Decomposition Products.—Shake about 0.1 Gm. of the salt with 10 mils of ether; the latter acquires not more than a pale reddish color.

Uses.—This remarkable compound is devoid of narcotic properties, but is expectorant in doses of one-twentieth of a grain (0.003 Gm.), and a powerful emetic, by the mouth, in one-sixth grain (0.01 Gm.) and, hypodermically, in one-twelfth grain (0.005 Gm.) doses; it should be employed with caution to avoid excessive emesis.

ÆTHYLMORPHINÆ HYDROCHLORIDUM. U. S. Ethylmorphine Hydrochloride

[**Æthylmorph. Hydrochl.**—ETHYLMORPHINE CHLORIDE]

The hydrochloride [$C_{19}H_{23}O_3NHCl + 2H_2O$ or $C_{17}H_{17}ON(OH)(OC_2H_5).HCl + 2H_2O = 385.69$] of an alkaloid prepared from morphine by ethylation. Preserve it in well-closed containers, protected from light.

Preparation.—It is prepared by subjecting morphine to the action of ethyl iodide in the presence of sodium or potassium hydroxide and purifying and salifying the resulting product.

Official Description.—It is a white or yellowish, microcrystalline powder.

Odor and Reaction.—Odorless. An aqueous solution of the salt (1 in 20) is neutral to litmus.

Solubility.—One Gm. of Ethylmorphine Hydrochloride dissolves in 8 mils of water and in 22 mils of alcohol at 25° C. (77° F.); slightly soluble in ether or chloroform.

Tests for Identity.—It melts at about 123° C. (253.4° F.) with decomposition.

Add a drop of ferric chloride T.S. to a solution of about 0.01 Gm. of the salt in 10 mils of sulphuric acid and warm it on a water bath; the color of the mixture will become at first green, then deep violet-blue, and, after the addition of a drop of nitric acid, deep red.

Add silver nitrate T.S. to an aqueous solution of the salt (1 in 20); a white precipitate insoluble in nitric acid is produced.

Impurities and Tests for Impurities.—No weighable ash remains on incinerating 0.2 Gm. of Ethylmorphine Hydrochloride.

Ammonium Compounds.—Heat 5 mils of an aqueous solution of the salt (1 in 20) with 5 mils of potassium hydroxide T.S. on a water bath; no vapors showing an alkaline reaction with litmus paper are evolved at once.

Morphine.—Dissolve about 0.05 Gm. of potassium ferricyanide in 10 mils of distilled water, add a drop of ferric chloride T.S., then 1 mil of an aqueous solution of the salt (1 in 100); no green or blue color is produced at once.

Uses.—This alkaloid is commonly sold under the name *dionin*, and is used as a substitute for morphine, although it is less likely to cause nausea and depression. Dose, one-fourth grain (0.015 Gm.).

DIACETYLMORPHINA. U. S. Diacetylmorphine

[**Diacetylmorph.**]

An alkaloid [$C_{21}H_{23}O_5N$ or $C_{17}H_{17}(O.C_2H_3O)_2ON = 369.19$] prepared from morphine by acetylization. Preserve it in well-closed containers, protected from light.

Preparation.—When alkaloidal morphine is heated with acetyl chloride, the synthetic alkaloid, diacetylmorphine is produced. The product must be washed with water and weak solution of sodium carbonate and crystallized from hot alcohol.

Official Description.—It occurs as a white, crystalline powder.

Odor and Reaction.—Without odor. Its saturated alcoholic solution is alkaline to moistened litmus paper.

Solubility.—One Gm. of Diacetylmorphine dissolves in about 1700 mils of water, 31 mils of alcohol, 1.4 mils of chloroform, and in 100 mils of ether at 25° C. (77° F.).

Tests for Identity.—It melts between 171.5° and 173.5° C. (341°–344° F.).

Dissolve about 0.01 Gm. of Diacetylmorphine in a few drops of nitric acid; a yellow color is produced, which gradually changes to greenish-blue. Heat about 0.1 Gm. of Diacetylmorphine with 1 mil of alcohol and 1 mil of sulphuric acid; ethyl acetate is produced, recognizable by its odor.

No weighable ash remains on incinerating 0.5 Gm. of Diacetylmorphine.

Impurities and Tests for Impurities.—*Other Alkaloids.*—Dissolve 0.2 Gm. of Diacetylmorphine in 5 mils of distilled water with the aid of a few drops of hydrochloric acid, and pour this solution slowly into 5 mils of potassium hydroxide T.S., shaking the test tube occasionally; a white precipitate forms, which quickly redissolves, yielding a clear solution.

Ammonium Salts.—On heating this solution no odor of ammonia is noticeable.

Readily Carbonizable Organic Impurities.—A solution of about 0.02 Gm. of Diacetylmorphine in two mils of sulphuric acid is colorless.

Morphine.—Dissolve about 0.05 Gm. of potassium ferricyanide in 10 mils of distilled water, add one drop of ferric chloride T.S. and then 1 mil of an alcoholic solution of Diacetylmorphine (1 in 100); no greenish or blue color is produced at once.

Foreign Alkaloids.—Dissolve 1 Gm. of Diacetylmorphine in 10 mils of distilled water and 5 mils of diluted hydrochloric acid in a porcelain dish and evaporate the solution on a water bath to a syrupy consistence (about 2 mils). Transfer this residue to a separatory funnel with the aid of 25 mils of distilled water, render it alkaline with sodium hydroxide solution (10 per cent.) and then shake it out with 3 successive portions of 15, 10 and 5 mils of chloroform, passing the chloroform solutions through a small filter previously moistened with chloroform. Carefully evaporate the combined chloroform solutions to dryness on a water bath, dissolve the residue in 10 mils of fiftieth-normal sulphuric acid V.S., add a few drops of methyl red T.S. and titrate the excess of acid with fiftieth-normal potassium hydroxide V.S. Not less than 7.5 mils of the latter is required.

Uses.—This alkaloid, usually known as *heroin* or *heroine,* is used as a sedative in cough mixtures and to relieve moderate pain. It must be used with caution, as it is one of the most dangerous habit-forming drugs and may be sold only under the regulations of the Harrison Act (see page 1316). Dose, one-twentieth grain (0.003 Gm.).

DIACETYLMORPHINÆ HYDROCHLORIDUM. U. S. Diacetylmorphine Hydrochloride

[**Diacetylmorph Hydrochl.**—Diacetylmorphine Chloride]

The hydrochloride [$C_{21}H_{23}O_5N.HCl + H_2O$ or $C_{17}H_{17}(O.C_2H_3O)_2ON.HCl + H_2O = 423.68$] of the alkaloid diacetylmorphine. Preserve it in well-closed containers, protected from light.

Preparation.—It may be prepared by mixing diacetylmorphine with distilled water, carefully neutralizing with hydrochloric acid, concentrating, and crystallizing.

Official Description.—It is a white, crystalline powder.

Odor and Reaction.—Without odor. An aqueous solution of Diacetylmorphine Hydrochloride (1 in 20) is neutral or only faintly acid to litmus.

Solubility.—One Gm. of Diacetylmorphine Hydrochloride dissolves in 2 mils of water at 25° C. (77° F.); soluble in alcohol; insoluble in chloroform or ether at 25° C. (77° F.).

Tests for Identity.—It melts at about 230° C. (446° F.) with decomposition.

An aqueous solution of the salt with silver nitrate T.S. yields a white precipitate insoluble in nitric acid.

Impurities and Tests for Impurities.—In other respects the salt responds to the tests of identity and purity under *Diacetylmorphina,* omitting the melting point.

N. F. Preparation.—Elixir Terpini Hydratis et Diacetylmorphinæ.

Uses.—The same as for diacetylmorphine. Dose, one-twentieth grain (0.003 Gm.).

COTARNINÆ HYDROCHLORIDUM. U. S. Cotarnine Hydrochloride

[Cotarn. Hydrochl.—Cotarnine Chloride]

Quarternary oxymethyl-oxymethylene-dihydro-isoquinoline chloride [$C_{12}H_{14}O_3NCl$ or $(CH_3O)\ (CH_2O_2).C_9H_6N\ (CH_3)Cl = 255.58$] obtained by hydrolyzing narcotine, and treating the resulting cotarnine [$(CH_3O)\ (CH_2O_2)C_8H_5(CHO).NH(CH_3)$] with hydrochloric acid.

Preparation.—It is prepared by oxidizing narcotine with nitric acid or a mixture of sulphuric acid and manganese dioxide, or by boiling narcotine with water until hydrolyzed.

Official Description.—It occurs as a yellow, crystalline powder; deliquescent in moist air.

Odor and Reaction.—Odorless. Its aqueous solution (1 in 20) is neutral to litmus.

Solubility.—It is very soluble in water and alcohol, yielding yellow solutions.

Tests for Identity.—Silver nitrate T.S. when added to an aqueous solution of Cotarnine Hydrochloride produces a white precipitate insoluble in nitric acid. About 0.2 Gm. of Cotarnine Hydrochloride, dissolved in 10 mils of distilled water, yields a brown precipitate of cotarnine periodide on the addition of 10 mils of tenth-normal iodine V.S. When this precipitate is collected on a filter and dried to constant weight over sulphuric acid, it melts between 142° C. (287.6° F.) and 144° C. (291.2° F.).

Heat gradually 0.1 Gm. of Cotarnine Hydrochloride over a Bunsen burner; it is decomposed, evolving characteristic, disagreeable vapors and yielding a reddish-brown liquid, which gradually changes to a hard charred mass. No weighable ash remains on the incineration of this mass.

Impurities and Tests for Impurities.—Dissolve about 0.5 Gm. of Cotarnine Hydrochloride in 10 mils of distilled water and add 2 mils of an aqueous solution of sodium hydroxide (15 per cent.). A milk-white precipitate is produced which dissolves on agitation, but is reprecipitated from the solution after standing for some time, leaving the supernatant liquid clear and but faintly yellow.

Uses.—It is used to check bleeding from small blood vessels, as certain forms of nose bleeding and slow hemorrhages. It is known commercially as *stypticin.*

CINCHONA. U. S. Cinchona

[Cinch.—Yellow Cinchona Calisaya Bark Yellow Peruvian Bark]

The dried bark of *Cinchona Ledgeriana* Moens, *Cinchona Calisaya* Weddell, and of hybrids of these with other species of *Cinchona* (Fam. *Rubiaceæ*), yielding not less than 5 per cent. of the alkaloids of Cinchona.

Official Description.—In quills or curved pieces of variable length, bark from 3 to 5 mm. in thickness, or in small broken fragments or in transversely curved pieces from 3 to 7 mm. in thickness; externally gray, rarely brownish-gray, with numerous intersecting transverse and longitudinal fissures having nearly vertical sides, and usually with patches of foliaceous lichens with their small, brownish-black apothecia; when the outer bark is absent, the color externally is cinnamon-brown; inner surface light cinnamon-brown, finely striate; fracture of the outer bark short and granular, of the inner bark finely splintery.

Odor and Taste.—Odor faintly aromatic; taste very bitter and somewhat astringent.

Tests for Identity and Purity.—The powder is reddish-brown; bast-fibers spindle-shaped, yellowish, from 0.3 to 1.35 mm. in length, with thick, strongly lignified, lamellated walls having slit-like, oblique pores; starch grains single or 2- to 5-compound, the individual grains spherical or plano-convex and from 0.003 to 0.015 mm. in diameter; sphenoidal micro-crystals of calcium oxalate numerous.

Heat 1 Gm. of powdered Cinchona in a dry test tube; a tarry distillate forms, having a purplish color and a somewhat granular appearance.

U. S. P. Preparations.—Fluidextractum Cinchonæ; Tinctura Cinchonæ.

N. F. Preparation.—Extractum Cinchonæ.

CINCHONA RUBRA. U. S. Red Cinchona

[**Cinch. Rub.**—Red Peruvian Bark]

The dried bark of *Cinchona succirubra* Pavon (Fam. *Rubiaceæ*), or of its hybrids, yielding not less than 5 per cent. of the alkaloids of Red Cinchona.

Official Description.—In quills or curved pieces of variable length, bark from 2 to 4 mm. in thickness, or in small broken fragments or in transversely curved pieces from 3 to 7 mm. in thickness; externally gray, grayish-brown, or reddish-brown, more or less rough from corky protuberances, occasionally with transverse fissures which are rarely numerous or much intersected, and having their sides sloping, and with occasional patches of foliaceous lichens; inner surface reddish or orange brown, distinctly striate; fracture short and granular in the outer bark, shortly and rather coarsely splintery in the inner bark.

Odor and Taste.—Odor slight; taste very bitter and astringent.

Tests for Identity and Purity.—The powder is light brown; bast-fibers and sphenoidal micro-crystals of calcium oxalate, resembling those in cinchona; starch grains resembling those of cinchona relatively few, from 0.003 to 0.01 mm. in diameter.

Heat 1 Gm. of powdered Red Cinchona in a dry test tube; a tarry distillate forms having a bright red color.

Assay.—Proceed as directed under *Cinchona*, using 5 Gm. of Red Cinchona.

U. S. P. Preparation.—Tinctura Cinchonæ Composita.

N. F. Preparations.—Fluidextractum Cinchonæ Aquosum; Gargarisma Guaiaci Compositum (from Compound Tincture of Cinchona).

The value of cinchona bark depends entirely upon the percentage of alkaloids present in it; and, as barks are found in the market greatly varying in quality, it is necessary to prove their worth by assay. The official assay is as follows:

Assay.—Introduce 5 Gm. of Cinchona, in No. 40 powder, into a 500-mil flask and add 200 mils of a mixture of chloroform, 1 volume, and ether, 2 volumes. Stopper the flask, shake it well, and let it stand ten minutes. Then add 5 mils of ammonia water, shake the flask frequently for one hour, and let it stand from eight to ten hours. Now add 10 mils of distilled water, shake the mixture vigorously and when the drug has settled, decant 160 mils of the solution, representing 4 Gm. of Cinchona. Filter it through a pledget of purified cotton into a separator, and rinse both cylinder and cotton with ether. Completely extract the alkaloids from the chloroform-ether solution by shaking out repeatedly with weak sulphuric acid. Collect the acid solutions in a separator, add ammonia water until the solution is distinctly alkaline to litmus, and completely extract the alkaloids by shaking out repeatedly with chloroform. Filter each portion of chloroform as it comes from the separator through a pledget of purified cotton into a tared flask, and wash the funnel and cotton with chloroform. Evaporate the chloroform on a water bath, add 5 mils of alcohol to the residue, and again evaporate. Repeat the evaporation with alcohol and dry the residue at 100° C. (212° F.) to constant weight. The weight will be the amount of total alkaloids from 4 Gm. of Cinchona (see Proximate Assays, Chapter LXII).

About twenty alkaloids have been discovered in cinchona barks. Some of these are found in only one kind of bark, some are doubtless "split products"—that is, not existing naturally in the bark, but the result of the action of chemical agents upon it.

Quinine, Quinidine, Cinchonine, and *Cinchonidine* are the most important alkaloids found in cinchona barks, and they, or their important salts, will be considered in separate articles. The acids present are *kinic,* or *quinic, quinotannic,* and *kinovic,* or *quinovic.* The neutral principle is *kinovin,* or *quinovin,* while *cinchonic red,* volatile oil, and red and yellow coloring matter are also present. The first four of the alkaloids in the following list are used in medicine. The list is as follows:

Natural Alkaloids.—Quinine, $C_{20}H_{24}O_2N_2$; Quinidine, $C_{20}H_{24}O_2N_2$; Cinchonine, $C_{19}H_{22}ON_2$; Cinchonidine, $C_{19}H_{22}ON_2$; Quinamine,

$C_{19}H_{24}O_2N_2$; Conquinamine, $C_{19}H_{24}O_2N_2$; Homoquinine, $C_{39}H_{46}O_4N_4$; Cinchonamine, $C_{19}H_{24}ON_2$; Paytine, $C_{21}H_{24}ON_2.H_2O$; Homocinchonidine, $C_{19}H_{22}ON_2$; Cusconine, $C_{23}H_{28}O_4N_2$; Cusconidine, $C_{23}H_{28}O_4N_2$; Concusconine, $C_{22}H_{26}O_4N_2$; Aricine, $C_{23}H_{28}O_4N_2$; Paricine, $C_{16}H_{18}ON_2$; Paytamine, $C_{21}H_{24}ON_2$; Hydroquinine, $C_{20}H_{26}O_2N_2$; Hydroquinidine, $C_{20}H_{26}O_2N_2$; Cinchotine, $C_{19}H_{24}ON_2$; Hydrocinchonine, $C_{19}H_{24}ON_2$; Hydrocinchonidine, $C_{19}H_{24}ON_2$; Diquinidine, $C_{40}H_{46}O_3N_4$; Cupreine, $C_{19}H_{22}O_2N_2$.

The Artificial Alkaloids are: Quinicine, $C_{20}H_{24}O_2N_2$; Cinchonicine, $C_{19}H_{22}ON_2$; Quinamicine, $C_{19}H_{24}O_2N_2$; Apoquinamine, $C_{19}H_{22}ON_2$. These are chiefly produed by the action of heat upon the natural alkaloids and usually in the presence of diluted acids. In addition there have been many others made which are not of pharmaceutical interest.

One of the principal difficulties in preserving galenical preparations of cinchona arises from the alteration and precipitation which the cinchotannic acid and its compounds undergo upon keeping. Glycerin has proved to be very useful by dissolving and holding these in solution, and hence it is present in nearly every one of the preparations.

Uses.—Cinchona is a febrifuge and tonic in doses of fifteen grains (1 Gm.).

QUININA. U. S. Quinine

[Quin.]

An alkaloid [$C_{20}H_{24}O_2N_2 + 3H_2O = 378.26$] obtained from the bark of various species of *Cinchona* (Fam. *Rubiaceæ*). Preserve it in well-closed containers, protected from light.

Preparation.—This alkaloid is usually made by adding to the cooled acid solution of the sulphate a quantity of ammonia water or solution of sodium hydroxide just sufficient to precipitate the quinine, carefully avoiding an excess.

Official Description.—It occurs as a white, micro-crystalline powder; efflorescent in dry air.

Odor, Taste, and Reaction.—Odorless, having a bitter taste, developing rather slowly, but intense and persistent. Its alcoholic solution (1 in 10) is lævorotatory and alkaline to litmus.

Solubility.—One Gm. of Quinine dissolves in 1560 mils of water, 0.8 mil of alcohol, 1.1 mils of chloroform, 1.9 mils of ether, and in 1890 mils of ammonia water at 25° C. (77° F.); also in 800 mils of boiling water.

Tests for Identity.—A solution of Quinine in diluted sulphuric acid shows a vivid blue fluorescence.

Add 2 or 3 drops of bromine T.S. to 1 mil of an aqueous solution of Quinine (1 in 100) made with the aid of just sufficient diluted sulphuric acid to effect solution and then add 1 mil of ammonia water; the liquid acquires an emerald-green color, due to the formation of thalleioquin.

Quinine loses not more than 15 per cent. of its weight when dried to constant weight at 100° C. (212° F.).

Incinerate about 1 Gm. of Quinine; not more than 0.1 per cent. of ash remains.

Impurities and Tests for Impurities.—*Organic Impurities.*—A solution of about 0.1 Gm. of Quinine in 2 mils of sulphuric acid is not darker than light yellow.

Morphine.—This solution is not colored red on the subsequent addition of a few drops of nitric acid.

Ammonium Salts.—Heat about 0.2 Gm. of Quinine with 2 mils of potassium hydroxide T.S.; the odor of ammonia is not evolved.

Other Cinchona Alkaloids.—Dissolve 1.74 Gm. of Quinine in 20 mils of alcohol, dilute the solution with 50 mils of hot distilled water and neutralize it with normal sulphuric acid V.S., using methyl red T.S. as indicator. Evaporate the liquid to dryness on a water bath, powder the residue, mix it in a test tube with 20 mils of distilled water and complete the test for other cinchona alkaloids as directed under *Quininæ Sulphas.*

N. F. Preparations.—Elixir Formatum Compositum; Oleatum Quininæ; Syrupus Ferri, Quininæ et Strychninæ Phosphatum; Syrupus Hypophosphitum Compositus.

Uses.—The alkaloid quinine is usually a part of a manufacturing process when some salt of quinine is to be prepared. The Pharmacopœia gives the following dose: tonic, one and one-half grains (0.1 Gm.), anti-malarial, at least fifteen grains (1 Gm.) daily.

QUININÆ SULPHAS. U. S. Quinine Sulphate
[Quin. Sulph.]

The sulphate $[C_{20}H_{24}O_2N_2)_2.H_2SO_4 + 7H_2O = 872.62]$ of the alkaloid quinine. Preserve it in well-closed containers, protected from light.

Preparation.—The processes which are used for making quinine sulphate, commercially, are regarded as valuable trade secrets, and the manufacturers carefully guard them. The following process, which was formerly official, illustrates one method of making the sulphate of the principal alkaloid from cinchona:

Take of yellow cinchona, in coarse powder, 48 oz. troy; hydrochloric acid, 3½ oz. troy; lime in fine powder, 5 oz. troy; animal charcoal, in fine powder, sulphuric acid, alcohol, water, distilled water, each, a sufficient quantity. Boil the cinchona in 13 pints of water mixed with one-third of the hydrochloric acid, and strain through muslin. Boil the residue twice successively with the same quantity of water and acid as before, and strain. Mix the decoctions, and, while the liquid is hot, gradually add the lime, previously mixed with 2 pints of water, stirring constantly, until the quinine is completely precipitated. Wash the precipitate with distilled water, and, having pressed, dried, and powdered it, digest it in boiling alcohol. Pour off the liquid, and repeat the digestion several times, until the alcohol is no longer rendered bitter. Mix the liquids, and distil off the alcohol until a brown viscid mass remains. Upon this, transferred to a suitable vessel, pour 4 pints of distilled water, and, having heated the mixture to the boiling point, add as much sulphuric acid as may be necessary to dissolve the quinine. Then add 1½ oz. troy of animal charcoal, boil the liquid for two minutes, filter while hot, and set it aside to crystallize. Should the liquid, before filtration, be entirely neutral, acidulate it very slightly with sulphuric acid; should it, on the contrary, change the color of litmus paper to a bright red, add more animal charcoal. Separate the crystals from the liquid, dissolve them in boiling distilled water slightly acidulated with sulphuric acid, add a little animal charcoal, filter the solution, and set it aside to crystallize. Lastly, dry the crystals on bibulous paper with a gentle heat, and keep them in a well-stoppered bottle. The mother-water may be made to yield an additional quantity of quinine sulphate by precipitating the quinine with ammonia water, and treating the precipitated alkaloid with distilled water, sulphuric acid, and animal charcoal, as before.

The hydrochloric acid forms with the alkaloids soluble hydrochlorides. The lime decomposes the salts by uniting with the acid, and the alkaloids are precipitated with the excess of lime. These are dissolved out with boiling alcohol, the solution evaporated, acidulated with sulphuric acid, decolorized with animal charcoal, and crystallized.

Sodium hydroxide is often used instead of lime to precipitate the alkaloids, because quinine is less soluble in a solution of sodium chloride than in calcium chloride, while several manufacturers prefer to use amyl alcohol for exhausting the lime precipitate of alkaloids. Oil of turpentine and refined petroleum have also been used as solvents to some extent.

At least three sulphates of quinine have been obtained, of which two are now official. The first of these, $(C_{20}H_{24}O_2N_2)_2.H_2SO_4 + 7H_2O$, is "diquinic sulphate," is known and prescribed in Great Britain as *Quininæ Disulphas,* and is the official salt known as quinine sulphate, or *Quininæ Sulphas,* U. S.; the second, formed by dissolving the first in diluted sulphuric acid, has the formula $C_{20}H_{24}O_2N_2.H_2SO_4 + 7H_2O$, and is the official quinine bisulphate, or *Quininæ Bisulphas,* U. S.; while the third, which is not official, is the acid sulphate, $C_{20}H_{24}O_2N_2.2H_2SO_4 + 7H_2O$, and may be obtained from a solution of quinine in an excess of diluted sulphuric acid.

Official Description.—It occurs in white, silky, light, flexible, glistening crystals, making a very light and easily compressible mass, or as hard, prismatic, monoclinic needles. It effloresces rapidly when exposed to dry air, and then becomes lusterless; when exposed to light, it acquires a brownish tint.

Odor, Taste, and Reaction.—Odorless, and having a persistent, very bitter taste. Its saturated aqueous solution is neutral or not more than slightly alkaline to litmus.

Solubility.—One Gm. of Quinine Sulphate dissolves in 725 mils of water, 107 mils alcohol, and 30 mils of glycerin at 25° C. (77° F.); also in 47 mils of water at 80° C. (176° F.), in about 12 mils of alcohol at 60° C. (140° F.); slightly soluble in chloroform or ether. It is freely soluble in a mixture of 7 volumes of chloroform and 4 volumes of dehydrated alcohol.

Tests for Identity.—When acidulated with diluted sulphuric acid, its saturated aqueous solution develops a vivid blue fluorescence.

When heated to 60° C. (140° F.) or when exposed to dry air, it loses all but two molecules of its water of crystallization.

Barium chloride T.S. produces in an aqueous solution of the salt a white precipitate, insoluble in hydrochloric acid.

Add 1 or 2 drops of bromine T.S. to 10 mils of an aqueous solution of the salt (about 1 in 1000) and then introduce an excess of ammonia water; the liquid acquires an emerald-green color, due to the formation of thalleioquin.

It loses not more than 16.2 per cent. of its weight when dried to constant weight at 110° C. (230° F.).

Incinerate about 2 Gm. of Quinine Sulphate; not more than 0.05 per cent. of ash remains.

Impurities and Tests for Impurities.—*Ammonium Sulphate or Other Inorganic Salts.*—One Gm. of the salt dissolves completely when heated to 50° C. (122° F.) in 7 mils of a mixture of 2 volumes of chloroform and 1 volume of dehydrated alcohol, and the solution remains clear on cooling.

Organic Impurities.—A solution of about 0.1 Gm. of the salt in 2 mils of sulphuric acid is not darker than light yellow.

Morphine.—This solution is not colored red by the subsequent addition of a few drops of nitric acid.

Other Cinchona Alkaloids.—Dry Quinine Sulphate (which must be neutral or slightly alkaline to litmus) at 50° C. (122° F.) for two hours, and then agitate 1.8 Gm. of the dried salt with 20 mils of distilled water at 65° C. (149° F.) for half an hour. Allow the mixture to cool to 15° C. (59° F.), macerate it at this temperature for two hours, with occasional shaking, and then filter it through a filter paper of from 8 to 10 cm. in diameter. Transfer 5 mils of this filtrate to a test tube and mix it gently (without shaking) with 7 mils of ammonia water, which must contain not less than 10 per cent. nor more than 10.2 per cent. of NH_3, have a temperature of 15° C. (59° F.), and be added at once. A clear liquid is produced.

If the temperature during the maceration has been 16° C. (60.8° F.), 7.5 mils of ammonia water may be added; if 17° C. (62.6° F.), 8 mils may be added.

N. F. Preparations.—Elixir Cinchonæ Alkaloidorum and in other Elixirs containing Cinchona alkaloids in combination with Iron, Bismuth, etc.; Elixir Ferri Pyrophosphatis, Quininæ et Strychninæ; Pilulæ Antiperiodicæ; Pilulæ Ferri, Quininæ, Aloes et Nucis Vomicæ; Pilulæ Ferri, Quininæ, Strychninæ et Arseni Mites; Pilulæ Opii, Digitalis et Quininæ.

Uses.—Quinine sulphate is used as an antiperiodic, tonic, and antipyretic. The tonic dose is one and one-half grains (0.1 Gm.), the anti-malarial dose, at least fifteen grains (1 Gm.). It may be given in the form of pills or in solution. In the latter case it is better to suspend it in syrup without using acid, with the addition of a little fluidextract of glycyrrhiza and a small quantity of ammonia water.

QUININÆ BISULPHAS. U. S. Quinine Bisulphate
[Quin. Bisulph.]

The acid sulphate [$C_{20}H_{24}O_2N_2.H_2SO_4 + 7H_2O = 548.41$] of the alkaloid quinine. Preserve it in well-closed containers, protected from light.

Preparation.—This salt is made by adding sulphuric acid to quinine sulphate suspended in water, evaporating the solution, and crystallizing the bisulphate.

Official Description.—It occurs in colorless, transparent, or whitish, orthorhombic crystals or small needles. It effloresces on exposure to air, and turns yellow on exposure to light.

Odor, Taste, and Reaction.—Odorless, and having a very bitter taste. Its aqueous solution (1 in 20) is strongly acid to litmus and has a blue fluorescence.

Solubility.—One Gm. of Quinine Bisulphate dissolves in 9 mils of water, 23 mils of alcohol, 15 mils of glycerin, 625 mils of chloroform and in 2500 mils of ether, at 25° C. (77° F.); also in 0.7 mil of boiling water and 0.7 mil of alcohol at 60° C. (140° F.).

Tests for Identity.—Add 1 or 2 drops of bromine T.S. to 1 mil of an aqueous solution of Quinine Bisulphate (1 in 100) and then add 1 mil of ammonia water; the liquid acquires an emerald-green color, due to the formation of thalleioquin.

Barium chloride T.S. added to an aqueous solution of the salt produces a white precipitate, insoluble in hydrochloric acid.

Quinine Bisulphate loses not more than 25 per cent. of its weight when dried to constant weight at 100° C. (212° F.).

Incinerate about 2 Gm of Quinine Bisulphate; not more than 0.05 per cent. of ash remains.

Impurities and Tests for Impurities.—*Organic Impurities.*—A solution of about 0.1 Gm. of the salt in 2 mils of sulphuric acid is not darker than light yellow.

Morphine.—This solution is not colored red by the subsequent addition of a few drops of nitric acid.

Cinchona Alkaloids.—Dissolve 2.52 Gm. of Quinine Bisulphate in 50 mils of hot distilled water and neutralize the solution with normal sodium hydroxide V.S., using methyl red T.S. as indicator. Evaporate the solution to dryness on a water bath, powder the residue, mix it in a test tube with 20 mils of distilled water and complete the test for other cinchona alkaoids as directed under *Quininæ Sulphas.*

N. F. Preparations.—Tinctura Antiperiodica; Tinctura Antiperiodica sine Aloe.

Uses.—The bisulphate has been introduced into medicine in preference to the ordinary sulphate, because of its greater solubility. Being about eighty times more soluble, it is better adapted for making into pills than is the sulphate. It contains about 15 per cent. less of the alkaloid than does the sulphate. The difference is to some extent compensated for by the greater solubility, and the dose given is usually the same as that of the sulphate.

QUININÆ HYDROCHLORIDUM. U. S. Quinine Hydrochloride [Quin. Hydrochl.—Quinine Chloride]

The hydrochloride [$C_{20}H_{24}O_2N_2.HCl + 2H_2O = 396.71$] of the alkaloid quinine. Preserve it in well-closed containers, protected from light.

Preparation.—Quinine hydrochloride may be made by double decomposition between quinine sulphate and barium chloride, or by dissolving the alkaloid quinine in diluted hydrochloric acid, evaporating, and crystallizing.

Official Description.—It occurs in white, silky, glistening needles. The salt effloresces when exposed to warm air.

Odor, Taste, and Reaction.—Odorless, and having a very bitter taste. Its aqueous solution (1 in 20) is neutral or not more than slightly alkaline to litmus.

Solubility.—One Gm. of Quinine Hydrochloride dissolves in 18 mils of water, 0.8 mil of alcohol, 7 mils of glycerin, 0.7 mil of chloroform, and in 340 mils of ether at 25° C. (77° F.); also in 0.5 mil of water at 80° C. (176° F.).

Tests for Identity.—Its aqueous solution is not fluorescent, except when highly diluted, or when diluted sulphuric acid is added to it.

Silver nitrate T.S. produces in an aqueous solution of the salt a white precipitate, insoluble in nitric acid.

Add 1 or 2 drops of bromine T.S. to 1 mil of a solution of Quinine Hydrochloride (1 in 100) and then introduce 1 mil of ammonia water; an emerald-green color is produced, due to the formation of thalleioquin.

Quinine Hydrochloride loses not more than 10 per cent. of its weight when dried to constant weight at 120° C. (248° F.).

Incinerate about 2 Gm. of Quinine Hydrochloride; not more than 0.05 per cent. of ash remains.

Impurities and Tests for Impurities.—*Organic Impurities.*—A solution of about 0.1 Gm. of the salt in 2 mils of sulphuric acid is not darker than light yellow.

Morphine.—This solution is not colored red by the subsequent addition of a few drops of nitric acid.

Sulphate.—Ten mils of an aqueous solution of the salt (1 in 50) acidulated with hydrochloric acid is not rendered more than faintly turbid by a few drops of barium chloride T.S.

Barium.—The addition of a few drops of diluted sulphuric acid to 10 mils of an aqueous solution of the salt (1 in 20) produces no turbidity.

Cinchona Alkaloids.—Dissolve 2.75 Gm. of Quinine Hydrochloride in 20 mils of distilled water at 65° C. (149° F.) in a test tube of about 80 mils capacity, add a solution of 1.5 Gm. of crystallized sodium sulphate in 10 mils of distilled water warmed to 65° C. (149° F.), and maintain the mixture at this temperature for half an hour, shaking it frequently and thoroughly in the stoppered tube. Cool it to 15° C. (59° F.) and keep it at this temperature for two hours, shaking it occasionally. Now filter the liquid through a filter paper of from 8 to 10 cm. diameter and complete the test for other cinchona alkaloids with 5 m ilsof the filtrate as directed under *Quininæ Sulphas.*

N. F. Preparations.—Elixir Ferri, Quininæ et Strychninæ; Syrupus Phosphatum cum Quinina et Strychnina.

Uses.—This salt is used like the sulphate but it is much more soluble. The dose is the same as for the sulphate.

QUININÆ DIHYDROCHLORIDUM. U. S. Quinine Dihydrochloride [Quin. Dihydrochl.]

The dihydrochloride [$C_{20}H_{24}O_2N_2.2HCl = 397.15$] of the alkaloid quinine. Preserve it in well-closed containers, protected from light.

Preparation.—It may be prepared by dissolving 100 parts of quinine hydrochloride in 200 parts of distilled water and adding 37 parts of 25 per cent. hydrochloric acid, the proportion to produce the dihydrochloride.

Official Description.—It occurs as a white powder.

Odor, Taste, and Reaction.—Odorless, and having a very bitter taste. Its aqueous solution (1 in 20) is strongly acid to litmus.

Solubility.—One Gm. of Quinine Dihydrochloride dissolves in about 0.6 mil of water and in 12 mils of alcohol at 25° C. (77° F.); it is slightly soluble in chloroform and very slightly soluble in ether.

Tests for Identity.—Silver nitrate T.S. added to an aqueous solution of the salt (1 in 20) produces a white precipitate, insoluble in nitric acid.

Add 1 or 2 drops of bromine water T.S. to 1 mil of an aqueous solution of the salt (1 in 100) and then add an excess of ammonia water; an emerald-green color is produced, due to the formation of thalleioquin.

Incinerate about 2 Gm. of Quinine Dihydrochloride; not more than 0.05 per cent. of ash remains.

Impurities and Tests for Impurities.—*Readily Carbonizable Impurities.*—A solution of about 0.1 Gm. of the salt in 2 mils of sulphuric acid is not darker than yellow.

Sulphate.—Ten mils of an aqueous solution of the salt (1 in 50) is not rendered more than faintly turbid by the addition of a few drops of barium chloride T.S.

Barium.—The addition of a few drops of diluted sulphuric acid to 10 mils of an aqueous solution of the salt (1 in 20) produces no turbidity.

Cinchona Alkaloids.—Dissolve 1.8 Gm. of Quinine Dihydrochloride in 10 mils of distilled water, add a slight excess of ammonia water and extract the precipitate by shaking the mixture with three successive portions of 20, 10 and 10 mils each of chloroform. Evaporate the combined chloroform extracts to dryness on a water bath, dissolve the residue in 25 mils of alcohol, dilute it with 50 mils of hot distilled water and neutralize the liquid with normal sulphuric acid V.S., using methyl red T.S. as indicator. Now evaporate the liquid to dryness on a water bath, powder the residue, mix it with 20 mils of distilled water in a test tube, and complete the test for other cinchona alkaloids as directed under *Quininæ Sulphas.*

Uses.—Its therapeutic effects are similar to the other quinine salts, but its great solubility makes it a favorite salt of quinine for hypodermic administration. The dose is the same as the sulphate.

QUININÆ HYDROBROMIDUM. U. S. Quinine Hydrobromide

[Quin. Hydrobr.—QUININE BROMIDE]

The hydrobromide [$C_{20}H_{24}O_2N_2.HBr + H_2O = 423.16$] of the alkaloid quinine. Preserve it in well-closed containers, protected from light.

Preparation.—Quinine hydrobromide may be made by decomposing 40 parts of quinine sulphate dissolved in 400 parts of hot alcohol with 11 parts of potassium bromide dissolved in 30 parts of distilled water. Potassium sulphate crystallizes out, and the quinine hydrobromide in solution may be obtained by evaporation and crystallization. In drying the salt, care must be observed not to subject the crystals to heat sufficient to fuse them. A warm, dry atmosphere should be relied upon to effect the drying, and all unnecessary exposure to light should be avoided.

Quinine hydrobromide may also be made by double decomposition between quinine sulphate and barium bromide, both in hot alcoholic solution. It is sometimes made by dissolving the alkaloid quinine in hot diluted hydrobromic acid until the latter is no longer acid to litmus paper, evaporating, and crystallizing.

Official Description.—It occurs in white, light, silky needles. The salt effloresces on exposure to the air.

Odor, Taste, and Reaction.—Odorless, and having a very bitter taste. Its saturated aqueous solution is neutral or not more than slightly alkaline to litmus.

Solubility.—One Gm. of Quinine Hydrobromide dissolves in 40 mils of water, 0.9 mil of alcohol, 7 mils of glycerin, 0.6 mil of chloroform, and in 23 mils of ether at 25° C. (77° F.); also in 3.2 mils of water at 80° C. (176° F.).

Tests for Identity.—Its aqueous solution when strongly acidulated with diluted sulphuric acid has a vivid blue fluorescence.

Precipitate a saturated aqueous solution of the salt with sodium hydroxide T.S.; filter, supersaturate the filtrate with acetic acid, and then add chloroform and a little chlorine water, and shake the mixture; the chloroform assumes a reddish-brown color.

Add 1 to 2 drops of bromine T.S. to 1 mil of an aqueous solution of Quinine Hydrobromide (1 in 100) and then add 1 mil of ammonia water; the liquid acquires an emerald-green color, due to the formation of thalleioquin.

Quinine Hydrobromide loses not more than 5 per cent. of its weight when dried to constant weight at 100° C. (212° F.).

Incinerate about 2 Gm. of Quinine Hydrobromide; not more than 0.05 per cent. of ash remains.

Impurities and Tests for Impurities.—*Organic Impurities.*—A solution of about 0.1 Gm. of the salt in 2 mils of sulphuric acid is not darker than light yellow.

Morphine.—On the addition of 0.1 mil of nitric acid to this solution an orange color is produced, due to the liberation of bromine, but no deep color, fading to orange, is noticeable.

Sulphate.—Ten mils of an aqueous solution of the salt (1 in 50), acidulated with hydrochloric acid, is not rendered more than faintly turbid by a few drops of barium chloride T.S.

Barium.—The addition of a few drops of diluted sulphuric acid to 10 mils of a hot aqueous solution of the salt (1 in 20) produces no turbidity.

Other Cinchona Alkaloids,—Dissolve 2.93 Gm. of Quinine Hydrobromide in 20 mils of distilled water at 65° C. (149° F.) in a test tube of about 80 mils capacity, add a solution of 1.5 Gm. of crystallized sodium sulphate in 10 mils of distilled water warmed to 65° C. (149° F.) and maintain the mixture at this temperature for half an hour, shaking it frequently and thoroughly in the stoppered tube. Then cool it to 15° C. (59° F.) and keep it at this temperature for two hours, shaking it occasionally. Now filter the liquid through a filter paper of 8 to 10 cm. diameter and complete the test for other cinchona alkaloids with 5 mils of the filtrate as directed under *Quininæ Sulphas.*

Uses.—Quinine hydrobromide is sometimes used hypodermically. Its dose is that of the sulphate.

QUININÆ SALICYLAS. U. S. Quinine Salicylate

[Quin. Salicyl.]

The salicylate [$C_{20}H_{24}O_2N_2.C_7H_6O_3 + H_2O = 480.28$] of the alkaloid quinine. Preserve it in well-closed containers, protected from light.

Preparation.—Quinine salicylate may be made by double decomposition between solutions of quinine hydrochloride and ammonium salicylate, or by saturating an alcoholic solution of quinine with an alcoholic solution of salicylic acid and purifying the crystals.

Official Description.—It occurs in colorless needles; permanent in the air. It often assumes a pinkish color on keeping.

Odor, Taste, and Reaction.—Odorless; having a bitter taste. Its saturated aqueous solution is alkaline to litmus.

Solubility.—One Gm. of Quinine Salicylate dissolves in 14 mils of alcohol, 13 mils of glycerin, 25 mils of chloroform, and in 160 mils of ether at 25° C. (77° F.); slightly soluble in water.

Tests for Identity.—When this solution is treated with a drop of ferric chloride T.S., a violet color develops.

Add 1 or 2 drops of bromine T.S. to 10 mils of an aqueous solution of Quinine Salicylate and then introduce an excess of ammonia water; an emerald-green color is produced, due to the formation of thalleioquin.

It loses not more than 5 per cent. of its weight when dried to constant weight at 100° C. (212° F.).

Incinerate about 2 Gm. of Quinine Salicylate; not more than 0.05 per cent. of ash remains.

Impurities and Tests for Impurities.—*Sulphate.*—Shake about 0.4 Gm. of the salt with 20 mils of distilled water and 1 mil of nitric acid; separate portions of 10 mils each of the filtered solution are not rendered more than slightly turbid by the addition of a few drops of barium chloride T.S.

Chloride.—nor more than slightly opalescent by a few drops of silver nitrate T.S.

Other Cinchona Alkaloids.—Mix 2.21 Gm. of Quinine Salicylate in a separator with 10 mils of distilled water, add 5 mils of ammonia water, and shake the liquid with three successive portions of 25, 20 and 10 mils, respectively, of ether. Evaporate the combined ether solutions to dryness on a water bath, dissolve the residue in 20 mils of alcohol, dilute it with 50 mils of hot distilled water, and neutralize the liquid with normal sulphuric acid V.S., using methyl red T.S. as indicator. Evaporate it to dryness on a water bath, powder the residue, mix it with 20 mils of distilled water in a test tube and complete the test for other cinchona alkaloids as directed under *Quininæ Sulphas.*

Uses.—Quinine salicylate is preferred to quinine sulphate by some physicians when they wish to obtain the medicinal action of the salicylic constituent. The dose is the same as the sulphate.

QUININÆ TANNAS. U. S. Quinine Tannate

[Quin. Tann.]

A compound of the alkaloid quinine with tannic acid, of somewhat varying composition and containing not less than 30 per cent. nor more than 35 per cent. of anhydrous quinine ($C_{20}H_{24}O_2N_2$). Preserve it in well-closed containers, protected from light.

Preparation.—It may be prepared by dissolving 12 Gm. of tannic acid in 75 mils of distilled water and pouring the solution slowly and with constant stirring into a solution of 10 Gm. of quinine sulphate in a mixture of 15 mils of diluted sulphuric acid and 150 mils of water. Three Gm. of tannic acid and 3 Gm. of sodium bicarbonate are each dissolved in 50 mils of distilled water, the solutions filtered and mixed, and the mixture added to the quinine-tannin mixture first prepared. The resulting precipitate is collected on a strainer, washed, heated on a water bath, in a porcelain dish, until it becomes resin-like, and finally dried in the air and powdered.

Official Description.—It is a pale yellow or yellowish-white, amorphous powder.

Odor and Taste.—Odorless and tasteless, or having not more than a slightly bitter and astringent taste.

Solubility.—It is slightly soluble in water, chloroform, or ether; somewhat more soluble in alcohol.

Tests for Identity.—When heated it melts to a purplish, viscous mass. Aqueous and alcoholic solutions of Quinine Tannate are colored blue-black by ferric chloride T.S.

Quinine Tannate loses not more than 10 per cent. of its weight when dried to constant weight at 100° C. (212° F.).

Incinerate about 0.5 Gm. of Quinine Tannate; not more than 0.3 per cent. of ash remains.

Impurities and Tests for Impurities.—*Chloride.*—Shake about 0.5 Gm. of Quinine Tannate with 50 mils of distilled water and 1 mil of nitric acid and filter the mixture. Ten mils of this filtrate is not colored by 1 mil of hydrogen sulphide T.S.; other portions of the filtrate, 10 mils each, do not become more than slightly turbid on the addition of a few drops of silver nitrate T.S.

Sulphate.—or on the addition of a few drops of barium chloride T.S.

Uncombined Quinine.—Shake about 2 Gm. of Quinine Tannate, accurately weighed, with three successive portions of 25 mils each of anhydrous ether, filter the ether solutions, and wash the filter with 10 mils of anhydrous ether. Upon the evaporation of the combined filtrates and washings and drying at 100° C. (212° F.) the residue does not exceed 0.5 per cent.

Assay.—Mix about 0.5 Gm. of Quinine Tannate, accurately weighed, in a separator with 10 mils of distilled water and 10 mils of ammonia water, and shake the mixture with 20 mils of ether, then with successive 10-mil portions of ether until the quinine is completely extracted. Upon the evaporation of the combined ethereal liquids and drying the residue to a constant weight at 100° C. (212° F.), the weight of the anhydrous quinine so obtained corresponds to not less than 30 per cent. nor more than 35 per cent. of the weight of the Quinine Tannate taken.

The alkaloid obtained in the above assay responds to the identity tests under *Quinina.*

N. F. Preparation.—Trochisci Quininæ Tannatis.

Uses.—This salt of quinine is relatively insoluble in water and consequently almost tasteless. For that reason it has been used in the N. F. troches. It is less certain in its action than the more soluble salts. Dose, three grains (0.2 Gm.).

QUININÆ ET UREÆ HYDROCHLORIDUM. U. S. Quinine and Urea Hydrochloride

[Quin. et Urea. Hydrochl.—QUININE AND UREA CHLORIDE]

A compound of the hydrochlorides of quinine and urea [$C_{20}H_{24}O_2N_2.HCl.CO(NH_2)_2.HCl + 5H_2O = 547.28$] which contains not less than 58 per cent. of anhydrous quinine. Preserve it in well-closed containers, protected from light.

Preparation.—It may be prepared by dissolving 40 parts of quinine hydrochloride in 30 parts of diluted hydrochloric acid, specific gravity 1.061, adding 6 to 6.1 parts of pure urea, warming to form solution, filtering through glass wool and crystallizing.

Official Description.—It occurs in colorless, translucent prisms or as a white, granular powder; permanent in the air.

Odor, Taste, and Reaction.—Odorless, and having a very bitter taste. An aqueous solution of the salt (1 in 20) is strongly acid to litmus.

Solubility.—One Gm. of Quinine and Urea Hydrochloride dissolves in 0.9 mil of water and in 2.4 mils of alcohol at 25° C. (77° F.).

Tests for Identity.—Silver Nitrate T.S. added to an aqueous solution of the salt produces a white precipitate, insoluble in nitric acid.

Add 2 mils of colorless nitric acid to a cold solution of about 1 Gm. of the salt in 2 mils of distilled water and cool the mixture at once at the temperature of melting ice. Crystalline leaflets of urea nitrate are formed on standing. Collect the crystals in a funnel upon glass wool, wash them with about 5 mils of a cold mixture of equal volumes of nitric acid and distilled water, and, after draining them, dissolve the crystals in a few mils of distilled water. The addition of a few drops of mercuric nitrate T.S. to the urea nitrate solution, followed by sodium hydroxide T.S., to only a slightly acid reaction, produces a white precipitate.

Incinerate about 2 Gm. of Quinine and Urea Hydrochloride; not more than 0.05 per cent. of ash remains.

Impurities and Tests for Impurities.—*Readily Carbonizable Matter.*—A solution of about 0.1 Gm. of the salt in 2 mils of sulphuric acid is not darker than light yellow.

Ammonium Compounds.—Warm 10 mils of an aqueous solution of the salt (1 in 20) with 5 mils of sodium hydroxide T.S. to 50° C. (122° F.); the odor of ammonia is not evolved at once.

The Quinine obtained by precipitating 60 mils of an aqueous solution of the salt (1 in 20) with sodium hydroxide T.S., washing it on a filter with cold distilled water until the washings give only a faint opalescence with silver nitrate T.S., and then drying it at about 50° C. (122° F.), responds to the test for identity, and 1.5 Gm. of it conforms to the requirement regarding other cinchona alkaloids under *Quinina.*

Assay.—Weigh accurately about 0.5 Gm. of Quinine and Urea Hydrochloride, dissolve it in 5 mils of distilled water in a separator, then add 5 mils of potassium hydroxide T.S., and shake the mixture with successive portions of 10, 5 and 5 mils, respectively, of ether or sufficient to completely extract the quinine. Upon evaporation of the combined ether-extracts and drying to constant weight at 100° C. (212° F.), the residue of anhydrous quinine corresponds to not less than 58 per cent. of the weight of the salt taken.

Uses.—It is used hypodermically in one to fifteen grain (0.065 to 1 Gm.) doses in the treatment of malaria and pneumonia. It is also much used as a local anæsthetic as a substitute for cocaine.

QUININÆ GLYCEROPHOSPHAS. N. F. Quinine Glycerophosphate

[**Quin. Glycerophos.**—QUININE GLYCERINOPHOSPHATE]

The glycerophosphate [$(C_{20}H_{24}O_2N_2)_2PO_4H_2(C_3H_7O_2) + 4H_2O =$ 892.60] of the alkaloid quinine. Preserve it in well-stoppered, amber-colored bottles.

Preparation.—It may be prepared by neutralizing quinine with glycerophosphoric acid and crystallizing the solution.

Official Description.—It occurs as fine, white crystalline needles or as a powder.

Odor and Taste.—Odorless and having a very bitter taste.

Solubility.—One gramme dissolves in about 850 mils of water, or 75 mils of alcohol at 25° C. (77° F.); very soluble in boiling alcohol; very slightly soluble in chloroform or ether; soluble in 20 parts of a mixture of one volume of alcohol and two volumes of chloroform.

Tests for Identity.—Quinine Glycerophosphate slowly loses part of its water of crystallization at room temperature and when heated to 100° C. (212° F.) becomes anhydrous. Incinerate 0.2 Gm. of the salt; no weighable residue remains.

The salt yields a clear solution with diluted sulphuric acid. An aqueous solution is not fluorescent, but becomes so upon the addition of a few drops of diluted sulphuric acid.

Add 1 mil of bromine T.S. to 10 mils of a saturated aqueous solution of the salt, and then follow with 1 mil of ammonia water; the liquid acquires an emerald-green color.

When the salt is heated with potassium bisulphate the odor of acrolein is given off.

Impurities and Tests for Impurities.—*Calcium.*—An aqueous solution of 0.1 Gm. of the salt in 10 mils of distilled water, made with the aid of acetic acid, does not produce a precipitate on the addition of ammonium oxalate T.S.

Sulphate.—Dissolve 0.1 Gm. of the salt in 10 mils of diluted hydrochloric acid; the solution does not become more than faintly turbid upon the addition of a few drops of barium chloride T.S.

Chloride.—Dissolve 0.1 Gm. of the salt in 10 mils of diluted nitric acid; the solution is not rendered more than faintly turbid on the addition of silver nitrate T.S.

Phosphate.—Add a slight excess of ammonia water to a saturated aqueous solution of the salt, and filter; the clear filtrate does not show more than a slight turbidity with magnesia mixture T.S.

Other Cinchona Alkaloids.—Mix about 2.5 Gm. of the salt in a separatory funnel with 15 mils of distilled water, add 5 mils of ammonia water, shake with three successive portions of 25, 15 and 10 mils of chloroform, respectively, and evaporate the chloroform solutions to dryness on a water bath. Dissolve 1.5 Gm. of this dry residue in 25 mils of alcohol, add 50 mils of hot distilled water, neutralize the liquid with normal sulphuric acid V.S., using methyl red T.S. as indicator and evaporate the liquid to dryness on a water bath. Powder the residue, mix it with 20 mils of distilled water and maintain the temperature of the mixture at 65° C. (149° F.) for thirty minutes, agitating frequently. Now cool the mixture to 15° C. (59° F.), macerate it at this temperature for two hours with occasional shaking, then filter it through a dry filter, of from 8 to 10 cm. in diameter, into a dry test tube. Transfer 5 mils of this filtrate to a test tube and mix it gently (without shaking) with 7 mils of ammonia water, which must contain not less than 10 per cent. nor more than 10.2 per cent of NH_3, must have a temperature of 15° C. (59° F.) and be added at once. A clear liquid is produced.

If the temperature during the maceration has been 16° C. (60.8° F.), add 7.5 mils of ammonia; if 17° C. (62.6° F.), add 8 mils.

N. F. Preparation.—Elixir Glycerophosphatum Compositum.

Uses.—The same as other salts of quinine, and in the same dose.

QUININÆ HYPOPHOSPHIS. N. F. Quinine Hypophosphite
[Quin. Hypophos.]

The hypophosphite [$C_{20}H_{24}O_2N_2HPH_2O_2 + 2H_2O = 426.31$] of the alkaloid quinine. Preserve it in well-stoppered, amber-colored bottles.

Preparation.—It may be prepared by neutralizing quinine with hypophosphorous acid and crystallizing the solution.

Official Description.—It occurs as fine, white, silky, glistening needles or prisms.

Odor and Taste.—Odorless and having a very bitter taste.

Solubility.—One gramme dissolves in about 35 mils of water, in 12.5 mils of alcohol, or in 27 mils of chloroform at 25° C. (77° F.); almost insoluble in ether.

Tests for Identity.—Heated to 100° C. (212° F.), Quinine Hypophosphite becomes anhydrous; the anhydrous salt melts at about 181° C. (357.8° F.). At a higher heat it fuses to a black mass and evolves vapors of phosphuretted hydrogen. Incinerate 0.2 Gm. of the salt no weighable residue remains.

Add 1 mil of bromine T.S. to 10 mils of an aqueous solution of the salt (1 in 1000) and then follow with 1 mil of ammonia water; the liquid acquires an emerald-green color.

Acidulate an aqueous solution of the salt (1 in 40) with a few drops of nitric acid, add silver nitrate T.S. and warm the liquid; a brown precipitate is formed, which, on standing, becomes black.

Impurities and Tests for Impurities.—*Chloride.*—Dissolve 0.1 Gm. of the salt in 10 mils of distilled water, and add a few drops of nitric acid; the solution is not rendered more than faintly turbid by the addition of silver nitrate T.S.

Sulphate.—Dissolve 0.1 Gm. of the salt in 10 mils of distilled water, and add a few drops of hydrochloric acid; the solution is not rendered more than faintly turbid by the addition of barium chloride T.S.

Other Cinchona Alkaloids.—To test this salt for excessive amounts of other cinchona alkaloids proceed as directed under *Quininæ Glycerophosphas.*

N. F. Preparation.—Liquor Hypophosphitum Compositus.

Uses.—The same as other salts of quinine and in the same dose.

QUININÆ VALERAS. N. F. Quinine Valerate
[Quin. Valer.]

The valerate [$C_{20}H_{24}O_2N_2HC_5H_9O_2 + H_2O = 443.30$] of the alkaloid quinine. Preserve it in well-stoppered, amber-colored bottles.

Preparation.—It may be prepared by dissolving quinine in alcohol and adding valeric acid until neutral or slightly in excess. The solution is then crystallized.

Official Description.—It occurs as white, lustrous crystals.

Odor, Taste, and Reaction.—Having an odor of valeric acid and an intensely bitter taste. Its aqueous solution is neutral or slightly alkaline to litmus.

Solubility.—It is sparingly soluble in cold water, soluble in hot water, becoming less soluble by age on account of loss of valeric acid; readily soluble in alcohol.

Tests for Identity.—Add a few drops of bromine water to 10 mils of an aqueous solution of the salt (1 in 1000), then add an excess of ammonia water; an emerald green color is produced.

An aqueous solution of the salt, acidulated with sulphuric acid, exhibits a blue fluorescence and has the odor of valeric acid.

Incinerate 1 Gm. of Quinine Valerate; not more than 0.1 per cent. of ash remains.

Impurities and Tests for Impurities.—*Readily Carbonizable Impurities.*—About 0.1 Gm. of the salt dissolves in 5 mils of sulphuric acid without producing more than a light yellow color.

Sulphate.—Ten-mil portions of the cold, saturated aqueous solution of the salt do not give more than a slight turbidity with barium chloride T.S. when acidulated with hydrochloric acid,

Chloride.—nor with silver nitrate T.S. when acidulated with nitric acid.

Other Cinchona Alkaloids.—To test this salt for excessive amounts of other cinchona alkaloids proceed as directed under *Quininæ Glycerophosphas.*

N. F. Preparation.—Elixir Quininæ Valeratis et Strychninæ.

Uses.—It is used like other quinine salts, but is supposed to have special value in neuralgia and migraine because of its being a valerate.

Unofficial Salts of Quinine

Euquinine, Quinine ethylcarbonate (Euchinin)	The quinine ester of ethyl carbonic acid. It is almost tasteless because it is insoluble. It is used in tablets. Dose, same as other quinine salts
Aristochin, Diquinine Carbonic Ester	The neutral carbonic ester of quinine. It is almost tasteless and insoluble
Saloquin, Quinine Salicylic Ester (Salochinin)	The salicylic acid ester of quinine. A tasteless salt of quinine

QUINIDINA. N. F. Quinidine

[Quinid.]

An alkaloid [$C_{20}H_{24}O_2N_2 = 324.21$], isomeric with quinine, obtained from the bark of various species of *Cinchona* (Fam. *Rubiaceæ*). Preserve it in well-closed containers, protected from light.

Preparation.—It is prepared by recrystallizing the mother liquors from quinine sulphate, adding ammonia water which does not dissolve the cinchona, then precipitating the quinidine from the ammonia solution by the addition of soda.

Official Description.—It occurs in acicular white crystals or as an amorphous white powder. When crystallized from alcohol it forms monoclinic prisms containing one molecule of alcohol, which it slowly loses on exposure to air, and rapidly loses when heated to 100° C. (212° F.). When precipitated by ammonia water from an aqueous solution of a salt of Quinidine, washed and dried, it forms an amorphous powder.

Odor, Taste, and Reaction.—Odorless and having an intense and persistent bitter taste.

Its alcoholic solution is dextrorotatory and its aqueous solution is alkaline to litmus.

Solubility.—When crystallized from an alcoholic solution, one gramme dissolves at 25° C. (77° F.) in about 32 mils of alcohol, 53 mils of ether, and 1.5 mils of chloroform; very slightly soluble in petroleum benzin and almost insoluble in water.

One gramme of dried amorphous Quinidine dissolves at 25° C. (77° F.) in about 36 mils of alcohol, 67 mils of ether, and 1.7 mils of chloroform; very slightly soluble in petroleum benzin and almost insoluble in water.

Tests for Identity.—Quinidine melts at about 168° C. (334.4° F.). Incinerate 0.2 Gm. of Quinidine; no weighable residue remains.

A solution of Quinidine in diluted sulphuric acid (1 in 1000) shows a strong blue fluorescence.

Add a few drops of bromine T.S. to 10 mils of an aqueous solution of Quinidine (1 in 1000), made with the aid of sufficient diluted sulphuric acid to produce complete solution, and then follow with ammonia water in slight excess; the liquid acquires an emerald-green color.

A solution of about 0.1 Gm. of Quinidine in 5 mils of sulphuric acid is not darker than pale yellow.

Impurities and Tests for Impurities.—*Difference from Quinine.*—Dissolve 0.5 Gm. of Quinidine in 10 mils of distilled water at 80° C. (176° F.), with just enough sulphuric acid to form a solution neutral to litmus paper, and add a neutral solution of 0.5 Gm. of potassium iodide in 5 mils of distilled water at 80° C. (176° F.). Agitate the mixture slightly, cool it to 15° C. (59° F.) and keep it at this temperature for one hour with occasional stirring. A white precipitate is formed.

Other Cinchona Bases.—Filter out the precipitate and add 2 drops of ammonia water to the filtrate, it does not cause more than a slight turbidity. Care must be taken to have the liquid perfectly neutral after the addition of the potassium iodide solution; if slightly acid, very dilute ammonia water must be added, drop by drop, with constant stirring, until exactly neutral to litmus paper.

N. F. Preparation.—Syrupus Quinidinæ.

Uses.—Because of its sparing solubility in water it is used in the N. F. to prepare what has been sold as a "*Tasteless Syrup of Quinidine.*" The dose is the same as quinine sulphate.

CINCHONINÆ SULPHAS. U. S. Cinchonine Sulphate
[Cinchonin. Sulph.]

The sulphate [$(C_{19}H_{22}ON_2)_2.H_2SO_4 + 2H_2O = 722.51$] of an alkaloid obtained from the bark of several species of cinchona. Preserve it in well-closed containers, protected from light.

Preparation.—In consequence of its greater solubility, cinchonine sulphate remains behind in the mother waters, when quinine sulphate crystallizes, in the process for preparing the latter. Cinchonine is obtained from quinine mother liquors by precipitation with solution of sodium hydroxide. The precipitated cinchonine is washed, converted into a sulphate by the addition of sulphuric acid, decolorized, and crystallized.

Official Description.—It occurs in white, lustrous prismatic crystals; permanent in the air.

Odor, Taste, and Reaction.—Odorless, and having a very bitter taste. A saturated aqueous solution of the salt is neutral or slightly alkaline to litmus and is dextrorotatory.

Solubility.—One Gm. of Cinchonine Sulphate dissolves in 60 mils of water, 12.5 mils of alcohol, 47 mils of chloroform, and in 3230 mils of ether at 25° C. (77° F.); also in 33 mils of water at 80° C. (176° F.) and in 7 mils of alcohol at 60° C. (140° F.).

Tests for Identity.—An aqueous solution of Cinchonine Sulphate (1 in 100) yields with barium chloride T.S. a white precipitate insoluble in hydrochloric acid.

Dried to constant weight at 100° C. (212° F.) Cinchonine Sulphate loses not more than 5 per cent. of its weight.

Incinerate about 1 Gm. of Cinchonine Sulphate; not more than 0.1 per cent. of ash remains.

Ten mils of a solution of the salt (1 in 1000) in diluted sulphuric acid exhibits only a slight, blue fluorescence.

Impurities and Tests for Impurities.—*Quinine or Cinchonidine Sulphate.*—One-tenth Gm. of the powdered salt dissolves completely or nearly so when shaken with 10 mils of chloroform at ordinary temperatures.

Readily Carbonizable Organic Impurities.—Add 0.1 Gm. of the salt to 2 mils of sulphuric acid; it imparts not more than a faint, yellow tinge to the acid.

N. F. Preparations.—Elixir Cinchonæ Alkaloidorum and in other Elixirs containing Cinchona Alkaloids in combination with Iron, Bismuth, etc.

Uses.—Cinchonine sulphate is used as a tonic and febrifuge. Its cheapness has led to its extensive employment as a substitute for quinine. The dose as an antiperiodic is, however, larger. The U. S. P. dose is two and one-half grains (0.15 Gm.), but fifteen to forty grains (1.0 to 2.6 Gm.) have been given.

CINCHONIDINÆ SULPHAS. U. S. Cinchonidine Sulphate
[Cinchonid. Sulph.]

The sulphate [$(C_{19}H_{22}ON_2)_2.H_2SO_4 + 3H_2O = 740.53$] of an alkaloid obtained from the bark of several species of cinchona. Preserve it in well-closed containers, protected from light.

Preparation.—This alkaloidal salt is also obtained from the quinine mother liquors by fractional crystallization. The Indian barks contain a larger proportion of it than the South American varieties.

Official Description.—It occurs in white, glistening silky needles or prisms; permanent in the air.

Odor, Taste, and Reaction.—Odorless and having a very bitter taste. A saturated aqueous solution of the salt is neutral or faintly alkaline to litmus and is lævorotatory.

Solubility.—One Gm. of Cinchonidine Sulphate dissolves in 65 mils of water, 90 mils of alcohol, and in 620 mils of chloroform at 25° C. (77° F.); also in 22 mils of water at 80° C. (176° F.), and in 41 mils of alcohol at 60° C. (140° F.); nearly insoluble in ether.

Tests for Identity.—When anhydrous it melts at about 200° C. (392° F.) with partial decomposition.

An aqueous solution of Cinchonidine Sulphate yields with barium chloride T.S. a white precipitate, insoluble in hydrochloric acid.

When dried to constant weight at 100° C. (212° F.), Cinchonidine Sulphate loses not more than 12 per cent. of its weight.

Incinerate about 1 Gm. of Cinchonidine Sulphate; not more than 0.1 per cent. of ash remains.

Ten mils of a solution of the salt (1 in 1000) in diluted sulphuric acid exhibits only a faint, blue fluorescence.

Impurities and Tests for Impurities.—*Cinchonidine.*—Add ammonia water to 25 mils of an aqueous solution of the salt, 1 in 80; a white precipitate is produced, which is but slightly soluble in ammonia water, but which, when freshly precipitated, dissolves in 5 mils of ether, the greater part afterwards separating in crystals.

Readily Carbonizable Impurities.—Add 2 mils of sulphuric acid to about 0.1 Gm. of the salt; not more than a faint, yellow color is developed.

Cinchonine or Quinidine Sulphate.—Macerate 0.5 Gm. of Cinchonidine Sulphate, with frequent agitation, at the ordinary temperature, with 20 mils of distilled water, then add 0.5 Gm. of potassium and sodium tartrate and continue the maceration with repeated agitation for one hour at 15° C. (59° F.), and filter the mixture. The addition of 1 drop of ammonia water to the filtrate produces not more than a slight turbidity.

N. F. Preparations.—Elixir Cinchonæ Alkaloidorum and in other Elixirs containing Cinchona Alkaloids in combination with Iron, Bismuth, etc.

Uses.—This salt closely resembles quinine sulphate in its medicinal effects, and may be used for the same purposes in somewhat larger doses. Dose, five to thirty grains (0.32 to 2.0 Gm.).

ACIDUM PHENYLCINCHONINICUM. U. S. Phenylcinchoninic Acid

[**Acid. Phenylcinch.**—PHENYL-QUINOLINE-CARBOXYLIC ACID]

An organic acid, 2-phenyl-quinoline-4-carboxylic acid [$C_{16}H_{11}O_2N$ or $C_6H_5.C_9H_5N.COOH = 249.10$].

Preparation.—It may be prepared by heating a mixture of one molecule each of pyroracemic acid, benzaldehyde, and aniline in dehydrated alcohol.

Official Description.—Occurs in small, colorless needles or as a white or yellowish-white micro-crystalline powder. It is permanent in the air.

Odor and Taste.—Odorless or having a slight odor resembling benzoic acid, and a bitter taste.

Solubility.—Insoluble in cold water; slightly soluble in cold alcohol, hot water or ether; readily soluble in hot alcohol.

Tests for Identity.—It melts at about 210° C. (410° F.) with partial decomposition.

A saturated solution of Phenylcinchoninic Acid in hot diluted hydrochloric acid yields a precipitate of reddish-brown crystals with platinic chloride T.S.

Dissolve about 1 Gm. of Phenylcinchoninic Acid in an excess of ammonia water, evaporate the solution to dryness on a water bath, or until free from the odor of ammonia, then dilute to 20 mils with distilled water, and filter. Separate portions of this filtrate yield a white, flocculent precipitate with silver nitrate T.S.; a yellowish, flocculent precipitate with lead acetate T.S.; and a green, flocculent precipitate with copper sulphate T.S.

No weighable ash remains on incinerating about 0.5 Gm. of Phenylcinchoninic Acid.

Uses.—This substance, commonly known as *atophan,* has been used in gouty and rheumatic conditions in doses of eight to twenty grains (0.5 to 1.3 Gm.). *Novatophan,* an allied compound, is used for the same purpose and is said to produce less digestive disorder.

NUX VOMICA. U. S. Nux Vomica
[Nux Vom.—Strychni semen P.I.]

The dried, ripe seeds of *Strychnos Nux-vomica* Linné (Fam. *Loganiaceæ*), yielding not less than 2.5 per cent. of the alkaloids of Nux Vomica.

Nux vomica contains *strychnine, brucine* ($C_{23}H_{26}O_4N_2$), probably *loganin, igasuric acid,* protein compounds, gum, fixed oil, sugar, etc. Of the total alkaloids from nux vomica, strychnine usually represents about one-third to one-half. Strychnine is official and will be considered separately. Brucine is readily soluble in alcohol and in chloroform; it is colored bright red by nitric acid, and its solution acquires a rose-red coloration with chlorine water. The presence of igasurine is now considered to be a mixture. The fixed oil is soluble in alcohol, and the alkaloids are soluble in the oil.

Official Description.—Orbicular, nearly flat, occasionally irregularly bent, from 10 to 30 mm. in diameter and from 4 to 5 mm. in thickness, very hard when dry; externally grayish or greenish-gray, covered with appressed hairs, giving it a silky luster, hilum indicated by a circular scar at the center of one of the flattened sides and connected with the micropyle at the edge by a ridge; internally showing a thin, hairy seed-coat and a large grayish-white endosperm at one end of which is embedded a small embyro with two broadly ovate, 5- to 7-nerved cotyledons.

Odor and Taste.—Inodorous; taste intensely and persistently bitter.

Tests for Identity and Purity.—The powder is light gray; consisting chiefly of thick-walled endosperm cells containing globules of a fixed oil and a few small aleurone grains, and fragments of strongly lignified, non-glandular hairs, the walls of the latter possessing large, circular, or long, slit-like pores. In the tissues of the adhering pulp occur a few small, nearly spherical starch grains.

Nux Vomica yields not more than 3.5 per cent. of ash.

Assay.—Introduce 15 Gm. of Nux Vomica, in No. 40 powder, into a 250-mil flask and add 150 mils of a mixture of chloroform, 1 volume, and ether, 2 volumes. Stopper the flask, shake it well and allow it to stand ten minutes, then add 10 mils of ammonia water, and, after shaking the flask vigorously every ten minutes during two hours, allow it to stand ten hours. Now add 25 mils of distilled water, again shake the flask well, and, when the drug has settled, decant 100 mils of the solution, representing 10 Gm. of Nux Vomica, and proceed as directed under Belladonnæ Radix, page 1348, beginning with the word "Filter," line six of the Assay. For the titration, dissolve the alkaloids from the residue with 10 mils of tenth-normal sulphuric acid V.S. instead of 5 mils. Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 36.4 milligrammes of the total alkaloids of Nux Vomica.

U. S. P. Preparations.—Extractum Nucis Vomicæ; Fluidextractum Nucis Vomicæ; Tinctura Nucis Vomicæ.

N. F. Preparations.—Elixir Phosphori et Nucis Vomicæ (from Tincture); Pilulæ Aloes et Podophylli Compositæ (from Extract); Pilulæ Ferri, Quininæ, Aloes et Nucis Vomicæ (from Extract); Pilulæ Laxativæ Post Partum (from Extract).

Uses.—Nux vomica is poisonous in large doses; in doses of one grain (0.065 Gm.) it is tonic.

STRYCHNINA. U. S. Strychnine
[Strych.]

An alkaloid [$C_{21}H_{22}O_2N_2 = 334.20$] obtained from nux vomica, and also obtainable from other seeds of the *Loganiaceæ*. Preserve it in well-closed containers.

Preparation.—Strychnine may be made by the process formerly official, as follows:

Take of nux vomica, rasped, 48 oz. troy; lime, in fine powder, 6 oz. troy; hydrochloric acid, 3½ oz. troy; alcohol, diluted alcohol, diluted sulphuric acid, ammonia water, purified animal charcoal, water, each, a sufficient quantity. Macerate the nux vomica for twenty-four hours in 16 pints of water, acidulated with one-third of the hydrochloric acid; then boil for two hours, and strain with expression through a strong muslin bag. Boil the residue twice successively in the same quantity of acidulated water, each time straining as before. Mix the decoctions and evaporate to the consistence of thin syrup; then add the lime previously mixed with a pint of water, and boil for ten minutes, frequently stirring. Pour the whole into a double muslin bag, and, having thoroughly washed the precipitate, press, dry, and powder it. Treat the powder repeatedly with diluted alcohol, in order to remove the brucine, until the washings are but faintly reddened by nitric acid. Then boil it repeatedly with alcohol until deprived of its bitterness, mix the several tinctures, and distil off the alcohol by means of a water bath. Having washed the residue, mix it with a pint of water, and, applying a gentle heat, drop in enough diluted sulphuric acid to neutralize and dissolve the alkaloid. Then add purified animal charcoal, and, having boiled the mixture for a few minutes, filter, evaporate, and set aside to crystallize. Dissolve the crystals in water, and add sufficient ammonia water to precipitate the strychnine. Lastly, dry this on bibulous paper, and keep it in a well-stoppered bottle.

In this process strychnine hydrochloride is formed. This is decomposed by lime, and the strychnine is dissolved out of the excess of lime with boiling alcohol (the brucine having been previously removed by treatment with diluted alcohol), the alcoholic solution is evaporated, and sulphuric acid added to dissolve the alkaloid; the solution is decolorized and evaporated to crystallize. The crystals of strychnine sulphate are dissolved and strychnine precipitated by adding ammonia water.

Official Description.—It occurs in colorless, transparent, prismatic crystals, or as a white crystalline powder; permanent in the air.

Odor, Taste, and Reaction.—Odorless. *Great caution must be used in tasting it and then only in very dilute solutions* which are exceedingly bitter.

Its saturated solutions are alkaline to litmus and are lævorotatory.

Solubility.—One Gm. of Strychnine dissolves in 6420 mils of water, 136 mils of alcohol, 5 mils of chloroform, and in 180 mils of benzene at 25° C. (77° F.); also in 3100 mils of boiling water and 34 mils of boiling alcohol; very slightly soluble in ether.

Tests for Identity.—Sulphuric Acid containing 1 per cent. of ammonium vanadate produces with Strychnine a deep violet-blue color, changing to a deep purple, and finally to a cherry-red.

Incinerate about 1 Gm. of Strychnine; not more than 0.1 per cent. of ash remains.

Impurities and Tests for Impurities.—*Readily Carbonizable Organic Impurities.*—A solution of about 0.1 Gm. of Strychnine in 2 mils of sulphuric acid is not more than pale yellow, but on adding a fragment of potassium dichromate, a deep blue color is momentarily produced, changing to deep violet, then to purplish-red, cherry-red, and finally to orange or yellow.

Brucine.—One mil of a mixture of equal volumes of nitric acid and distilled water, added to about 0.1 Gm. of Strychnine, may produce a yellow, but not a red or reddish color.

N. F. Preparations.—Elixir Ferri Pyrophosphatis, Quininæ et Strychninæ; Elixir Pepsini, Bismuthi et Strychninæ; Liquor Hypophosphitum Compositus; Liquor Strychninæ Acetatis; Pilulæ Aloini, Strychninæ et Belladonnæ; Pilulæ Aloini, Strychninæ et Belladonnæ Compositæ; Pilulæ Antidyspepticæ; Pilulæ Ferri, Quininæ, Strychninæ et Arseni Fortiores; Pilulæ Ferri, Quininæ, Strychninæ et Arseni Mites; Pilulæ Laxativæ Compositæ; Syrupus Ferri, Quininæ et Strychninæ Phosphatum; Syrupus Hypophosphitum Compositus.

Uses.—Strychnine is a cardiac and nerve stimulant, and is given in doses of one-fortieth of a grain (0.0015 Gm.). It may sometimes be given in doses of one-twentieth of a grain (0.003 Gm.).

STRYCHNINÆ NITRAS. U. S. Strychnine Nitrate

[Strych. Nit.]

The nitrate [$C_{21}H_{22}O_2N_2.HNO_3 = 397.21$] of the alkaloid strychnine. Preserve it in well-closed containers, protected from light.

Preparation.—Strychnine nitrate may be made by dissolving strychnine in warm diluted nitric acid, evaporating and crystallizing.

Official Description.—It occurs in colorless, glistening needles, or as a white, crystalline powder; permanent in the air.

Odor, Taste, and Reaction.—Odorless. *Great caution must be used in tasting it and then only in very dilute solutions* which are exceedingly bitter.

Its saturated aqueous solution is neutral or only slightly acid to litmus and is lævorotatory.

Solubility.—One Gm. of Strychnine Nitrate dissolves in 42 mils of water, 150 mils of alcohol, 50 mils of glycerin, and in 105 mils of chloroform at 25° C. (77° F.); also in 9 mils of boiling water and 77 mils of alcohol at 60° C. (140° F.); insoluble in ether.

Tests for Identity.—A solution of the salt, when poured carefully into a test tube upon a layer of sulphuric acid containing diphenylamine in solution, develops a blue color at the zone of contact.

When the salt is heated with hydrochloric acid, a bright red color is produced.

Impurities and Tests for Impurities.—In other respects it responds to the tests for identity and purity under *Strychnina.*

N. F. Preparation.—Syrupus Phosphatum cum Quinina et Strychnina.

Uses.—Strychnine nitrate is a cardiac and nerve stimulant, and is given in the dose of one-fortieth of a grain (0.0015 Gm.).

STRYCHNINÆ SULPHAS. U. S. Strychnine Sulphate

[Strych. Sulph.]

The sulphate [$(C_{21}H_{22}O_2N_2)_2.H_2SO_4 + 5H_2O = 856.56$] of the alkaloid strychnine. Preserve it in well-closed containers.

Preparation.—This salt is prepared during the process for making strychnine. (See Strychnina.)

Official Description.—It occurs in colorless or white, prismatic crystals, or as a white, crystalline powder; it is efflorescent in dry air.

Odor, Taste, and Reaction.—Odorless. *Great caution must be used in tasting it and then only in very dilute solutions* which are exceedingly bitter.

Its saturated aqueous solution (1 in 50) is neutral or only slightly acid to litmus.

Solubility.—One Gm. of Strychnine Sulphate dissolves in 32 mils of water, 81 mils of alcohol and in 220 mils of chloroform at 25° C. (77° F.); also in 7 mils of boiling water and 26 mils of alcohol at 60° C. (140° F.); freely soluble in glycerin; insoluble in ether.

Tests for Identity.—Barium chloride T.S. produces in a solution of the salt a white precipitate, insoluble in hydrochloric acid.

When dried to constant weight at 100° C. (212° F.) it loses not more than 11 per cent. of its weight.

Impurities and Tests for Impurities.—In other respects Strychnine Sulphate responds to the tests for identity and purity under *Strychnina.*

N. F. Preparations.—Elixir Cinchonæ Alkaloidorum, Ferri, Bismuthi et Strychninæ; Elixir Cinchonæ Alkaloidorum, Ferri et Strychninæ; Elixir Ferri, Quininæ et Strychninæ; Elixir Quininæ Valeratis et Strychninæ.

Uses.—Strychnine sulphate is more useful, medicinally, than strychnine, only because it is much more soluble. The dose is one-fortieth of a grain (0.0015 Gm.).

STRYCHNINÆ GLYCEROPHOSPHAS. N. F. Strychnine Glycerophosphate

[Strych. Glycerophos.—STRYCHNINE GLYCERINOPHOSPHATE]

The glycerophosphate [$(C_{21}H_{22}O_2N_2)_2PO_4H_2(C_3H_7O_2) + 6H_2O = 948.60$] of the alkaloid strychnine. Preserve it in well-stoppered bottles.

Preparation.—It may be made by dissolving strychnine in glycerophosphoric acid and evaporating and crystallizing the solution.

Official Description.—It occurs in white, rhombic crystals or as a white powder.

Odor, Taste, and Reaction.—Odorless; having at first a faint, sweet taste, afterward becoming intensely bitter. Its aqueous solution is neutral or slightly alkaline to litmus.

Solubility.—One gramme dissolves in about 350 mils of water, also in about 310 mils of alcohol; slightly soluble in chloroform, and very soluble in ether.

Tests for Identity.—On incinerating 0.2 Gm. of the salt it yields no weighable residue.

The addition of sulphuric acid to the salt produces no color, or at most only a slight yellowish coloration, but on subsequently adding a fragment of potassium dichromate a deep blue color is obtained, which changes to deep violet, then to purplish-red, cherry-red and finally to orange or yellow.

Add ammonia water in slight excess to a saturated aqueous solution of the salt; a white precipitate is formed which is readily soluble in chloroform.

Impurities and Tests for Impurities.—*Chloride.*—A saturated aqueous solution of the salt, acidulated with diluted nitric acid, is not rendered more than faintly turbid on the addition of silver nitrate T.S.

Sulphate.—A saturated aqueous solution of the salt, acidulated with hydrochloric acid shows not more than a slight turbidity on the addition of barium chloride T.S.

Phosphate.—Add a slight excess of ammonia water to an aqueous solution of the salt and filter the mixture; the filtrate shows not more than a slight turbidity with magnesia mixture T.S.

N. F. Preparation.—Elixir Glycerophosphatum Compositum.

Uses.—The same as other strychnine salts and in the same dose.

STRYCHNINÆ VALERAS. N. F. Strychnine Valerate

[Strych. Valer.]

The valerate [$C_{21}H_{22}O_2N_2.HC_5H_9O_2 = 436.28$] of the alkaloid strychnine. Preserve it in well-stoppered, amber-colored vials.

Preparation.—It may be made by dissolving strychnine in water with the aid of valeric acid and evaporating and crystallizing the solution.

Official Description.—It occurs as a white, crystalline powder.

Odor, Taste, and Reaction.—It has an odor of valeric acid and an intensely bitter taste. Its saturated aqueous solution is neutral or slightly alkaline to litmus.

Solubility.—It is sparingly soluble in water, becoming less soluble on keeping, through the loss of valeric acid; soluble in alcohol or chloroform; slightly soluble in ether.

Tests for Identity.—Dissolve about 0.05 Gm. of Strychnine Valerate in 2 mils of sulphuric acid; not more than a faint yellowish color appears, but on adding a fragment of potassium dichromate a deep violet color is produced which changes to orange or yellow.

When sulphuric acid is added to the salt, the odor of valeric acid is evolved.

Incinerate 1 Gm. of Strychnine Valerate; the ash does not exceed 0.1 per cent.

Impurities and Tests for Impurities.—*Sulphate.*—Ten-mil portions of an aqueous solution of the salt (1 in 100) are not affected at once by barium chloride T.S. when acidulated with hydrochloric acid.

Chloride.—nor by silver nitrate T.S. when acidulated with nitric acid.

Brucine.—About 0.02 Gm. of the salt, moistened with nitric acid, may be colored yellow, but not red or reddish.

N. F. Preparation.—Elixir Strychninæ Valeratis.

Uses.—The same as other strychnine salts and in the same dose.

LIQUOR STRYCHNINÆ ACETATIS. N. F. Solution of Strychnine Acetate

[**Liq. Strych. Acet.**—HALL'S SOLUTION OF STRYCHNINE]

	Metric	Old form
Strychnine	0.178 Gm.	3 gr.
Diluted Acetic Acid	3.500 mils	67 min.
Alcohol	25.000 mils	1 fl. oz.
Compound Tincture of Cardamom	1.000 mil	19 min.
Distilled Water, a sufficient quantity,		
To make	100 mils	4 fl. oz.

Dissolve the strychnine in the diluted acetic acid, add about 50 mils [old form 2 fl. oz.] of distilled water, then the alcohol, compound tincture of cardamom, and sufficient distilled water to make the product measure 100 mils [old form 4 fl. oz.] and filter.

Uses.—Similar to other salts of strychnine in a dose of ten minims (0.6 mil).

ERGOTA. U. S. Ergot

[**Ergot.**—SECALE CORNUTUM, P. I. ERGOT OF RYE SPURRED RYE]

The carefully dried sclerotium of *Claviceps purpurea* (Fries) Tulasne (Fam. *Hypocreaceæ*), replacing the grain of rye, *Secale cereale* Linné (Fam. *Gramineæ*), without the presence or admixture of more than 5 per cent. of seeds, fruits or other foreign matter. Before storing, dry Ergot at a temperature not exceeding 70° C. (158° F.), and preserve it, protected from light, in tightly-closed containers to which a few drops of chloroform or carbon tetrachloride are added from time to time to prevent attacks by insects.

Official Description.—Cylindraceous, obscurely three-angled, tapering towards both ends, obtuse, somewhat curved, from 1 to 4.5 cm. in length and from 3 to 5 mm. in thickness; externally purplish-black or brownish-black, longitudinally furrowed; fracture short, pinkish or reddish-white, sometimes grayish-white.

Odor and Taste.—Odor peculiar, disagreeable, free from mustiness; taste oily and disagreeable.

Tests for Identity and Purity.—Pour hot water on bruised Ergot; no ammoniacal or rancid odor develops.

The powder is grayish-brown, consisting chiefly of whitish fragments composed of false parenchyma of compacted hyphæ and a few purplish colored fragments of the outer layer of the sclerotium; mounts made in hydrated chloral T.S. or in sulphuric acid show the separation of numerous globules of a fixed oil, and many of the fragments are colored yellowish, reddish or rose-purple.

Shake 1 Gm. of the powdered drug with a mixture of 20 mils of water and one drop of hydrochloric acid, filter the mixture, make 4 mils of the filtrate alkaline with ammonia water and shake out with 10 mils of ether. Underlay 5 mils of this ethereal solution with 2 mils of sulphuric acid; a blue ring is formed at the zone of contact of the two liquids.

Ergot yields not more than 5 per cent. of ash.

U. S. P. Preparations.—Extractum Ergotæ; Fluidextractum Ergotæ.

N. F. Preparations.—Extractum Ergotæ Aquosum; Tinctura Ergotæ Ammoniata.

Assay.—The U. S. P. IX did not introduce an assay because of the difficulties and uncertainties of present methods. Chemical assays have been proposed, but, because of the complex character of the active constituents, they have not proven satisfactory. Biological assays are largely used; the blackening of the cock's comb, due to the contraction of the blood vessels, is one plan, while its activity upon uterine muscle and its effect upon blood-pressure are the other methods employed. These are being applied successfully in large laboratories. Ergot preparations, however, quickly deteriorate with age and even though standardized they cannot be depended upon when kept for an extended period. The N. F. has introduced an aqueous extract which is commonly called *ergotine*. This preparation contains practically none of the ergotoxine which is not soluble in aqueous menstruum.

Ergot owes its activity chiefly to the alkaloids *ergotinine*, $C_{35}H_{39}O_5N_5$, and *ergotoxine*, or *hydro-ergotinine*, $C_{35}H_{41}O_6N_5$, also to *para-hydroxyphenylethamine*, *beta-iminazolylethylamine*, *clavin*, and *ergotinic acid*. Ergotoxine is found in alcoholic extracts and produces the characteristic action on the cock's comb. It aids in the uterine and vascular action of ergot. Ergotinine is crystalline but weak in action. Para-hydroxyphenylethamine is closely related to epinephrine in structure and action. Beta-iminazolylethylamine lowers the blood-pressure and powerfully stimulates the uterus. Earlier investigators claimed the presence of numerous other substances, such as *sclerotic acid, sclererythrin, scleromucin, scleroiodin, picrosclerotin, scleroxanthin*, and *sclerocrystallin*, but it has been shown that these are mixtures. It also contains about 25 per cent. of fixed oil, mycose, and protein compounds. Diluted alcohol is a good solvent for the active principles.

Uses.—It is used as a parturient and hæmostatic. Dose, thirty grains (2 Gm.). Sclerotic acid has been used in medicine in doses of one-half to three-fourths of a grain (0.032–0.048 Gm.).

GELSEMIUM. U. S. Gelsemium

[**Gelsem.**—YELLOW JASMINE ROOT YELLOW JESSAMINE]

The dried rhizome and roots of *Gelsemium sempervirens* (Linné) Aiton filius (Fam. *Loganiaceæ*).

Official Description.—Rhizome cylindrical, usually in pieces from 3 to 20 cm. in length and from 3 to 30 mm. in diameter; externally light yellowish-brown, longitudinally wrinkled, with purplish-brown longitudinal lines and transverse fissures; the upper surface with a few stem scars, the under and side portions with numerous roots and root scars; fracture tough, splintery; internally light brown or pale yellow, bark thin, wood distinctly radiate, excentral, pith disintegrated. Roots light brown; fracture one-half transverse, the other oblique or splintery.

Odor and Taste.—Odor slight; taste bitter.

Tests for Identity and Purity.—Under the microscope, sections of the rhizome of Gelsemium show a strong development of cork, the walls being grayish or yellowish-brown and more or less lignified; a cortex made up chiefly of parenchyma containing starch and having in the outer portion small scattered groups of stone cells or sclerenchymatous fibers, and in the inner portion in the region of the medullary ray prisms of calcium oxalate; woody portion made up of broad wedges consisting of large tracheæ and fiber-tracheids separated by starch-bearing medullary rays, the innermost cells, or those nearer the pith, being strongly lignified, while the outermost layers, or those nearer the cortex, are non-lignified and may contain prisms of calcium oxalate; an internal phloem or sieve, the cells forming distinct, more or less rounded groups, the latter being partly surrounded by a thin-walled starch-bearing pith.

The powder is dark yellow, tracheæ with bordered pores numerous and conspicuous; spiral tracheæ few; bast-fibers and fiber-tracheids long and narrow, strongly lignified; starch grains spherical, from 0.004 to 0.008 mm. in diameter; calcium oxalate in monoclinic prisms from 0.015 to 0.03 mm. in length; occasional groups of stone cells or sclerenchymatous fibers, the walls being very thick, porous, and strongly lignified.

U. S. P. Preparations.—Extractum Gelsemii; Fluidextractum Gelsemii; Tinctura Gelsemii.

N. F. Preparation.—Elixir Sodii Salicylatis Compositum (from Fluidextract).

Gelsemium contains *gelsemine*, $C_{24}H_{28}O_4N_2$, *gelseminine*, $C_{22}H_{26}O_3N_2$, gelseminic acid, volatile oil, starch, resin, fat, coloring matter, etc.

Uses.—It is used as an antispasmodic and sedative. Dose, one and one-half grains (0.1 Gm.).

PHYSOSTIGMA. U. S. **Physostigma**

[**Physostig.**—CALABAR BEAN ORDEAL BEAN]

The dried ripe seeds of *Physostigma venenosum* Balfour (Fam. *Leguminosæ*), yielding not less than 0.15 per cent. of the alkaloids of Physostigma.

Physostigma contains *physostigmine* ($C_{15}H_{21}O_2N_3$), or *eserine,* as it is more frequently called. This alkaloid is amorphous and without taste, soluble in water, but more soluble in alcohol, ether, chloroform, carbon disulphide, and benzene. It also contains *eseramine* and physovenine, $C_{14}H_{18}O_3N_2$, and *eseridine* is obtained by the action of sulphuric acid on eserine, with physosterols and other alcohols, starch, protein compounds, mucilage, etc.

Official Description.—Oblong or ellipsoidal, somewhat compressed reniform, from 15 to 30 mm. in length and from 10 to 15 mm. in thickness; externally reddish or chocolate brown, smooth, somewhat wrinkled near the brownish-black groove, the latter being about 2 mm. in width and extending almost the entire length of the convex edge and in which are found frequently the remains of the white membranous funiculus, the margins of the seed-coat on both sides of the groove somewhat elevated, of a yellowish-red or brownish-red color and somewhat thickened; embryos large, white, with short hypocotyl and two concavo-convex cotyledons.

Taste.—Taste at first starchy, afterwards acrid.

Tests for Identity and Purity.—The powder is grayish-white, starch grains numerous, from 0.005 to 0.15 mm. in diameter, ellipsoidal or somewhat reniform, and usually with a distinct cleft and frequently with radiating or irregular fissures; fragments of seed-coat with very thick, reddish-brown cells, being either palisade-like or very irregular and resembling stone cells, but the walls are not lignified; an occasional fragment with tracheæ showing reticulate thickenings.

Physostigma yields not more than 3 per cent. of ash.

Assay.—Introduce 15 Gm. of Physostigma in No. 60 powder, into a flask of about 250 mils capacity, and add 150 mils of ether. Stopper the flask, shake it well and allow it to stand ten minutes, then add 10 mils of an aqueous solution of sodium bicarbonate (1 in 20) and shake the mixture vigorously at intervals during four hours. Now add 15 mils of distilled water, again shake the flask well, and, when the drug has settled, decant 100 mils of the ether solution, representing 10 Gm. of Physostigma. Filter the solution through a pledget of purified cotton into a beaker and rinse the graduate and cotton with ether. Add 20 mils of tenth-normal sulphuric acid V.S. and evaporate off the ether, stirring during the evaporation with a rubber-tipped glass rod. After the resinous and fatty matter has agglutinated, pour off the acid solution through a wetted filter into a separator. Redissolve the residue in the beaker in about 15 mils of ether, add 2 mils of tenth-normal sulphuric acid V.S., evaporate off the ether with continued stirring as before and pour the acid solution on the filter. Repeat this operation until all of the alkaloid is extracted and then wash the filter with distilled water until it is free from alkaloids. Collect the solution and washings in a separator, add sufficient sodium bicarbonate to make the solution decidedly alkaline to litmus and completely extract the alkaloids by shaking it out repeatedly with ether. Wash the combined ether solutions with 10 mils of distilled water, separate the water completely, and filter the ether solution, washing the container and filter with ether. Evaporate the ether solution to dryness, dissolve the alkaloids from the residue in exactly 5 mils of tenth-normal sulphuric acid V.S. and titrate the excess of acid with fiftieth-normal potassium hydroxide V.S., using cochineal T.S. as indicator.

Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 27.52 milligrammes of the alkaloids of Physostigma (see Chapter LXII, Proximate Assays).

U. S. P. Preparations.—Extractum Physostigmatis; Tinctura Physostigmatis.

Uses.—Physostigma is sedative, and acts as a powerful poison, contracting the pupil of the eye. Dose, one to three grains (0.065 to 0.2 Gm.).

PHYSOSTIGMINÆ SALICYLAS. U. S. **Physostigmine Salicylate**

[**Physostig. Salicyl.**—ESERINE SALICYLATE]

The salicylate [$C_{15}H_{21}O_2N_3.C_7H_6O_3 = 413.25$] of an alkaloid obtained from physostigma. Preserve it in small, well-closed containers, protected from light.

Preparation.—This salt may be made by adding 2 parts of physostigmine to a solution of 1 part of salicylic acid in 35 parts of boiling distilled water, and allowing the salt to crystallize on cooling.

Official Description.—It occurs in colorless or faintly yellowish, shining, acicular, or short columnar crystals. It acquires a red tint when long exposed to light and air.
Odor, Taste, and Reaction.—Odorless. *Great caution must be used in tasting it.* Its cold, saturated aqueous solution is neutral or at most only faintly acid to litmus.
Solubility.—One Gm. of Physostigmine Salicylate dissolves in 75 mils of water, 16 mils of alcohol, 6 mils of chloroform, and in 250 mils of ether at 25° C. (77° F.); also in 16 mils of water at 80° C. (176° F.) and in 5 mils of boiling alcohol.
Tests for Identity.—Upon standing twenty-four hours, this solution usually acquires a pink color. This color is produced rapidly by the addition of a few drops of sodium hydroxide T.S.
Ferric chloride T.S. produces a deep violet color in an aqueous solution of Physostigmine Salicylate; a solution of chlorinated lime added to an aqueous solution of the salt produces a red color.
Evaporate about 0.005 Gm. of the salt to dryness with a few drops of ammonia water; a blue residue is produced, which is soluble in alcohol, and, when so dissolved, yields a red, fluorescent solution upon the addition of acetic acid in excess.
No weighable ash remains on incinerating 0.1 Gm. of Physostigmine Salicylate.
Impurities and Tests for Impurities.—*Sulphate.*—Precipitate the salicylic acid from 10 mils of a cold, saturated aqueous solution of the salt with a slight excess of hydrochloric acid and filter the mixture; the filtrate is not rendered turbid at once by the addition of a few drops of barium chloride T.S.
Readily Carbonizable Impurities.—A solution of about 0.1 Gm. of Physostigmine Salicylate in 2 mils of sulphuric acid does not become darker than yellow within five minutes.

Uses.—The salts of physostigmine, or eserine, are used to contract the pupil of the eye. The advantage possessed by the salicylate is that it is more permanent and less liable to deliquesce. The dose for internal administration should not be more than one sixty-fourth of a grain (0.001 Gm.).

BELLADONNÆ FOLIA. U. S. Belladonna Leaves

[**Bellad. Fol.**—DEADLY NIGHTSHADE LEAVES BELLADONNÆ FOLIUM P. I.]

The dried leaves and tops of *Atropa Belladonna* Linné (Fam. *Solanaceæ*), without the presence or admixture of more than 10 per cent. of its stems or other foreign matter, and yielding not less than 0.3 per cent. of the total alkaloids of Belladonna Leaves.

Official Description.—Usually much twisted and matted together; leaves much crumpled; when soaked in water and spread out, the entire leaves from 6 to 20 cm. in length, 4 to 12 cm. in breadth, broadly ovate, summits acute, margins entire, narrowed into the long petioles; upper surfaces brownish-green, lower surfaces grayish-green, epidermis more or less papillose and slightly hairy; flowers with yellowish-purple, campanulate corollas; fruits globular, subtended by the calyx, dark green or greenish-brown, and with numerous small seeds. Stems of variable length not exceeding 7 mm. in diameter, longitudinally wrinkled, older parts smooth and usually hollow, younger parts flattened and finely hairy.
Odor and Taste.—Odor distinct, especially on moistening; taste somewhat bitter and acrid.
Tests for Identity and Purity.—The powder is dark green, consisting of irregular fragments of leaf tissues and woody elements; calcium oxalate in sphenoidal micro-crystals; hairs few, the non-glandular being simple, 2- to 5-celled, the glandular with stalks of 1 to 3 cells; tracheæ with annular, spiral, scalariform or reticulate thickenings and with bordered pores; starch grains and pollen grains few; occasional fragments of the stems of Belladonna with long, thin-walled and slightly lignified bast-fibers.
Rhaphides must not be present (leaves and stems of *Phytolacca decandra* Linné).
Belladonna Leaves yield not more than 20 per cent. of ash.
Assay.—Proceed as directed under *Belladonnæ Radix* (page 1348), using 15 Gm. of Belladonna Leaves, in No. 60 powder, increasing the amount of water added after mac-

eration to 25 mils and, before titration, treating the final residue twice with 5 mils of ether, evaporating to dryness each time.

Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 28.92 milligrammes of the total alkaloids of Belladonna Leaves.

U. S. P. Preparations.—Extractum Belladonnæ Foliorum (Pilular and Powdered); Tinctura Belladonnæ Foliorum; Unguentum Belladonnæ (from Pilular Extract).

N. F. Preparations.—Pilulæ Aloes et Podophylli Compositæ (from Pilular Extract); Pilulæ Aloini Compositæ (from Pilular Extract); Pilulæ Aloini, Strychninæ et Belladonnæ (from Pilular Extract); Pilulæ Aloini, Strychninæ et Belladonnæ Compositæ (from Pilular Extract); Pilulæ Antidyspepticæ (from Pilular Extract); Pilulæ Laxativæ Compositæ (from Pilular Extract).

BELLADONNÆ RADIX. U. S. Belladonna Root

[**Bellad. Rad.**—DEADLY NIGHTSHADE ROOT]

The dried root of *Atropa Belladonna* Linné (Fam. *Solanaceæ*), without the presence or admixture of more than 10 per cent. of its stem-bases or other foreign matter, and yielding not less than 0.45 per cent. of the total alkaloids of Belladonna Root. Preserve Belladonna Root in tightly-closed containers, adding a few drops of chloroform or carbon tetrachloride from time to time to prevent attack by insects.

Official Description.—Cylindrical or somewhat tapering, usually split into longitudinal pieces, from 0.5 to 2.5 cm. in thickness; externally pale brownish-gray, longitudinally wrinkled, outer layers of the periderm rather soft, frequently abraded, and thus showing lighter patches; fracture nearly smooth, mealy, on breaking, emitting a puff of dust consisting chiefly of starch grains; internally whitish, with a distinct cambium zone and yellowish wood wedges.

Odor and Taste.—Nearly inodorous; taste sweetish, afterwards bitterish and strongly acrid.

Tests for Identity and Purity.—Transverse sections of Belladonna Root when moistened with iodine T.S. are colored bluish-black and by transmitted light show an imperfectly radiate structure within and near a conspicuous cambium line. Under the microscope, sections exhibit a bark and wood composed mainly of parenchyma, the cells being filled with starch grains, single and 2- to 6- or more compound, the individual grains being somewhat spherical and from 0.003 to 0.03 mm. in diameter. A section cleared with hydrated chloral T.S. shows in both bark and wood occasional cells of parenchyma filled with sphenoidal micro-crystals of calcium oxalate; bark free from bast-fibers; wood containing scattered groups of large tracheæ with simple and bordered pores or reticulated thickenings, and associated in older roots with wood-fibers.

Stem fragments of Atropa Belladonna occur either separate or attached to the roots; light brown or greenish-brown; finely, longitudinally wrinkled, with transversed leaf-scars; pith frequently hollow.

Under the microscope, sections of Belladonna stem show beneath the endodermis an interrupted circle of bast-fibers either singly or in small groups, the walls of which are relatively thin and slightly lignified. In the internal phloem also occur isolated small groups of bast-fibers similar to those found in the inner bark.

The powder is light brown; starch grains numerous, from 0.003 to 0.030 mm. in diameter, spherical, plano-convex, polygonal, and 2- to 6- or more compound; sphenoidal micro-crystals numerous, from 0.003 to 0.010 mm. in length; fragments of cork cells and tracheæ with wood-fibers few; occasional fragments of stems of Belladonna showing long, thin-walled and slightly lignified bast-fibers.

Belladonna Root yields not more than 7 per cent. of ash.

Assay.—Introduce 15 Gm. of Belladonna Root, in No. 60 powder, into a 250-mil flask and add 150 mils of a mixture of chloroform, 1 volume, and ether, 2 volumes. Stopper the flask, shake it well and allow it to stand ten minutes, then add 5 mils of ammonia water and shake the flask vigorously every ten minutes during two hours. Now add 15 mils of distilled water, again shake the flask well, and, when the drug has settled, decant 100 mils of the solution, representing 10 Gm. of Belladonna Root. Filter the solution through a pledget of purified cotton into a separator, and rinse the graduate and cotton with a little ether. Completely extract the alkaloids from the solution by shaking out repeatedly with weak sulphuric acid. Collect the acid washings in a separator, add ammonia water until the solution is decidedly alkaline to litmus, and completely extract the alkaloids by shaking out repeatedly with chloroform. Evaporate the combined chloroform washings to dryness, dissolve the alkaloids from the residue in exactly 5 mils of tenth-normal sulphuric acid V.S., and titrate the excess of acid with fiftieth-normal potassium hydroxide V.S., using cochineal T.S. as indicator.

Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 28.92 milligrammes of the total alkaloids of Belladonna Root (see Proximate Assays, Chapter LXII).

U. S. P. Preparations.—Fluidextractum Belladonnæ Radicis; Linimentum Belladonnæ (from Fluidextract).

All of the alkaloids from the Solanaceæ stand in close chemical relation to each other, and recent investigations show that some are capable of being converted into others during the process of extraction.

Belladonna owes its activity to *atropine*, $C_{17}H_{23}O_3N$, and *hyoscyamine*, $C_{17}H_{23}O_3N$; *belladonnine* is also present. Atropine and some of the salts of hyoscyamine are official.

Uses.—Belladonna is narcotic and poisonous. It dilates the pupil of the eye. Dose, three-fourths to two grains (0.045 to 0.13 Gm.).

ATROPINA. U. S. Atropine

[Atrop.]

An alkaloid [$C_{17}H_{23}O_3N = 289.19$] obtained from belladonna and from some other plants of the *Solanaceæ*. Preserve it in well-closed containers, protected from light.

Preparation.—This alkaloid may be prepared by adding sulphuric acid to a concentrated alcoholic tincture of the root to convert the atropine into the sulphate, distilling off the alcohol, adding water to the residuary liquid, filtering to separate oil and resin, and treating the filtrate with potassium hydroxide and chloroform. By evaporating the latter, atropine is obtained. This is purified by redissolving the crystals and filtering the solution, decolorizing with animal charcoal and recrystallization.

Official Description.—White rhombic prisms.

Odor, Taste, and Reaction.—Odorless. *Great caution must be used in tasting it and then only in very dilute solution.* Its saturated aqueous solutions are alkaline to litmus and to phenolphthalein T.S.

Solubility.—One Gm. of Atropine dissolves in 455 mils of water, 2 mils of alcohol, about 27 mils of glycerin, 1 mil of chloroform, and in 25 mils of ether at 25° C. (77° F.); also in 90 mils of water at 80° C. (176° F.), and in 1.2 mils of alcohol at 60° C. (140° F.).

Tests for Identity.—It melts between 114° and 116° C. (237.2° and 240.8° F.).

Gold chloride T.S. yields in a solution of Atropine in dilute hydrochloric acid (1 in 50) a lusterless precipitate (distinction from *hyoscyamine*, which yields a lustrous precipitate).

Evaporate about 0.01 Gm. of Atropine to dryness in a porcelain dish on a water bath with a few drops of nitric acid; a yellow colored residue is produced. Cool this residue and add a few drops of alcoholic potassium hydroxide T.S. and a fragment of potassium hydroxide; an intensely violet color is produced. Hyoscyamine and hyoscine produce the same color, but the presence of strychnine or other alkaloids masks the reaction.

No weighable ash remains on incinerating 0.1 Gm. of Atropine.

Impurities and Tests for Impurities.—*Readily Carbonizable Impurities.*—About 0.1 Gm. of Atropine, dissolved in 2 mils of sulphuric acid, does not produce more than a slightly yellow solution.

Foreign Alkaloids.—Only a light yellow color is produced upon the further addition of 0.1 mil of nitric acid.

Foreign Alkaloids.—In a solution of Atropine in dilute hydrochloric acid (1 in 50) platinic chloride T.S. produces no precipitate.

Apoatropine, Belladonnine.—An aqueous solution of Atropine (1 in 60), made with the aid of a slight excess of diluted sulphuric acid, is rendered turbid by the addition of a slight excess of sodium hydroxide T.S., but no turbidity is produced immediately upon the addition of 2 mils of ammonia water to 5 mils of the solution.

N. F. Preparation.—Oleatum Atropinæ.

Uses.—Atropine is chiefly used to dilate the pupil of the eye. It is employed preferably as a solution in sterile olive oil or in an ointment vehicle. The sulphate, however, is preferred, on account of its greater solubility. It has the properties of belladonna when given internally, and is narcotic. Dose, the one hundred and sixtieth to one-sixtieth of a grain (0.0004 to 0.001 Gm.).

ATROPINÆ SULPHAS. U. S. Atropine Sulphate

[Atrop. Sulph.]

The sulphate [$(C_{17}H_{23}O_3N)_2H_2SO_4 + H_2O = 694.49$] of the alkaloid atropine.

Preparation.—Atropine sulphate may be prepared by suspending 120 grains of atropine in 4 fl. dr. of distilled water and adding very dilute sulphuric acid until the alkaloid is dissolved and the solution is neutral. The latter is then evaporated to dryness at a temperature not exceeding 37.7° C. (100° F.).

Official Description.—It occurs as a white, crystalline powder or in microscopical needles and prisms; efflorescent in dry air.

Odor, Taste, and Reaction.—Odorless. *Great caution must be used in tasting it and then only in very dilute solution.* An aqueous solution of the salt (1 in 20) is neutral to litmus.

Solubility.—One Gm. of Atropine Sulphate dissolves in 0.4 mil of water, 5 mils of alcohol, 2.5 mils of glycerin, 420 mils of chloroform and in 3000 mils of ether at 25° C. (77° F.); also in 2.5 mils of boiling alcohol.

Tests for Identity.—It usually melts between 188° and 191° C. (370.4° and 375.8° F.), but when anhydrous and free from hyoscyamine, it melts between 181° and 183° C. (357.8° and 361.4° F.).

Impurities and Tests for Impurities.—It responds to the other tests for identity and purity under *Atropina.*

Uses.—Atropine sulphate is preferred to the alkaloid for use as a mydriatic. An aqueous solution is generally employed for this purpose. The internal dose is from the one hundred and sixtieth to one-sixtieth of a grain (0.0004 to 0.001 Gm.).

HOMATROPINÆ HYDROBROMIDUM. U. S. Homatropine Hydrobromide

[Homatrop. Hydrobr.—HOMATROPINE BROMIDE]

The hydrobromide [$C_{16}H_{21}O_3N.HBr = 356.11$] of homatropine, an alkaloid obtained by the condensation of tropine and mandelic acid. Preserve it in well-closed containers, protected from light.

Preparation.—It is made by heating *tropine,* $C_8H_{15}ON$, with *mandelic* (*phenyl glycolic*) *acid,* in the presence of hydrochloric acid; ammonia is added, and the homatropine which is liberated is dissolved out by chloroform; the solution is evaporated, hydrobromic acid added, and the crystals of homatropine hydrobromide purified by recrystallization.

Official Description.—It occurs as a white, crystalline powder, or in rhombic prisms. Its solution when locally applied dilates the pupil of the eye.

Odor, Taste, and Reaction.—Odorless. *Great caution must be observed in tasting it, using only very dilute solutions.* Its aqueous solution (1 in 20) is neutral to litmus.

Solubility.—One Gm. of Homatropine Hydrobromide dissolves in 6 mils of water, 40 mils of alcohol, and in 420 mils of chloroform at 25° C. (77° F.); also in 12 mils of alcohol at 60° C. (140° F.); insoluble in ether.

Tests for Identity.—It melts at about 212° C. (413.6° F.), with partial decomposition.

Shake 2 mils of chloroform with 1 mil of an aqueous solution of the salt (1 in 10) to which a few drops of chlorine water have been added; the chloroform assumes a brownish color.

When added to solutions of Homatropine Hydrobromide, iodine T.S. produces a brown precipitate; silver nitrate T.S. in similar solutions produces a yellowish-white precipitate insoluble in nitric acid.

No weighable ash remains on incinerating 0.1 Gm. of Homatropine Hydrobromide.

Impurities and Tests for Impurities.—*Foreign Alkaloids.*—Separate portions of 1 mil each of an aqueous solution of the salt (1 in 20) are not precipitated by tannic acid T.S.; or, after acidulation with hydrochloric acid, by platinic chloride T.S.

Most Other Alkaloids Except Atropine and Hyoscyamine.—Add a slight excess of ammonia water to 1 mil of an aqueous solution of the salt (1 in 100), shake it out with chloroform and evaporate the chloroformic solution to dryness on a water bath. The residue becomes yellow and finally brick-red in color when warmed with about 1.5 mils of a solution made by dissolving 1 Gm. of mercuric chloride in 50 mils of a mixture of 5 volumes of alcohol and 3 volumes of distilled water.

Atropine, Hyoscyamine, or Hyoscine.—Evaporate about 0.01 Gm. of Homatropine Hydrobromide, with 5 drops of nitric acid, to dryness in a porcelain dish on a water bath; the residue acquires no violet color on the addition of a few drops of alcoholic potassium hydroxide T.S.

Uses.—Homatropine hydrobromide is preferred by many physicians to atropine as a mydriatic, because it is less toxic, and the effects subside far more rapidly. Dose, one hundred and twentieth of a grain (0.0005 Gm.).

SCOPOLAMINÆ HYDROBROMIDUM. U. S. Scopolamine Hydrobromide

[**Scopolamin. Hydrobrom.**—HYOSCINE HYDROBROMIDE SCOPOLAMINE BROMIDE]

The hydrobromide [$C_{17}H_{21}O_4NHBr + 3H_2O = 438.15$] of lævorotatory scopolamine, also known as hyoscine, obtained from various plants of the *Solanaceæ.* Preserve it in well-closed containers, protected from light.

Official Description.—It occurs in colorless, transparent, rhombic crystals, sometimes of large size; slightly efflorescent.

Odor, Taste, and Reaction.—Odorless. *Great caution must be used in tasting it, and then only in dilute solutions.* Its aqueous solution (1 in 20) is neutral or at most only slightly acid to litmus.

Solubility.—One Gm. of Scopolamine Hydrobromide dissolves in 1.5 mils of water and in 20 mils of alcohol at 25° C. (77° F.); slightly soluble in chloroform; insoluble in ether.

Tests for Identity.—When anhydrous it melts between 190° and 192° C. (374° and 377.6° F.).

The specific rotatory power of the salt, determined in an aqueous solution containing the equivalent of 5 Gm. of anhydrous Scopolamine Hydrobromide in 100 mils of solution at 25° C. (77° F.), is from –22° to –25.75° in a 100-mm. tube (see U. S. P., Test No. 21, Chapter LXII).

Add about 0.01 Gm. of the salt to 5 drops of nitric acid and evaporate it to dryness in a porcelain dish on a water bath; the residue yields a violet color upon the addition of alcoholic potassium hydroxide T.S. Silver nitrate T.S. produces in the aqueous solution of the salt a yellowish-white precipitate insoluble in nitric acid.

Shake 2 mils of chloroform with 1 mil of an aqueous solution of the salt (1 in 20) to which a few drops of chlorine water have been added; the chloroform assumes a brownish color.

When dried to constant weight at 100° C. (212° F.), it loses not more than 13 per cent. of its weight. It also loses its water of crystallization slowly over sulphuric acid.

No weighable ash remains on incinerating 0.1 Gm. of Scopolamine Hydrobromide.

Impurities and Tests for Impurities.—*Foreign Alkaloids.*—The addition of a few drops of ammonia water T.S. to 1 mil of an aqueous solution of the salt (1 in 20) causes no turbidity; the addition of potassium hydroxide T.S. to another portion of 1 mil of the aqueous solution causes only a whitish, transient turbidity.

Apoatropine.—Add 0.05 mil of tenth-normal potassium permanganate V.S. to 15 mils of an aqueous solution of the salt (1 in 100); the solution is not completely decolorized within five minutes.

Carbonizable Impurities.—The solution of about 0.1 Gm. of the salt in 1 mil of sulphuric acid is not more than faintly yellow.

Morphine.—Add a drop of nitric acid to this solution; an orange color is produced, due to the liberation of bromine, but no deep red color fading to orange is noticeable.

Uses.—Scopolamine hydrobromide is a powerful mydriatic and cerebral and spinal sedative. It is also known as *hyoscine hydrobromide,* and this title was recognized in the U. S. P. VIII in a separate article. Dose, one two-hundredth of a grain (0.0003 Gm.).

HYOSCYAMUS. U. S. Hyoscyamus

[Hyosc.—HENBANE HYOSCYAMI FOLIUM P. I.]

The dried leaves and flowering or fruiting tops of *Hyoscyamus niger* Linné (Fam. *Solanaceæ*), yielding not less than 0.065 per cent. of the alkaloids of Hyoscyamus.

Official Description.—Usually much wrinkled, with numerous stems and with the flowering or fruiting tops intermixed; leaves when entire attaining a length of 25 cm., a breadth of 10 cm., ovate or ovate-oblong, very inequilateral, the lower with short petioles, the upper sessile, summits acute, margins coarsely and angularly 1- to 4-toothed or lobed; grayish-green, glandular-hairy, particularly on the lower surfaces; flowers nearly sessile with an urn-shaped, unequally 5-toothed calyx and a campanulate corolla which in the fresh state is of a yellowish color; fruit a 2-locular pyxis, and enclosed in a large urn-shaped calyx with 5 acute teeth. Stems from 3 to 10 cm. in length and from 2 to 5 mm. in thickness, nearly cylindrical or somewhat compressed, longitudinally wrinkled and hairy.

Odor and Taste.—Odor heavy, distinctive; taste somewhat bitter and acrid.

Tests for Identity and Purity.—The powder is grayish-green; under the microscope, it exhibits calcium oxalate crystals usually in the form of 4- to 6-sided, isolated prisms, sometimes in twins, from 0.015 to 0.025 mm. in length, also occurring in spherical aggregates either isolated or attached to the prismatic crystals, sometimes in rosette aggregates, 0.02 mm. in diameter, and occasionally in sphenoidal micro-crystals; hairs numerous, of two kinds, the non-glandular from 2 to 10 cells in length, the glandular with a 1- to many-celled head and a 1- to 4-celled stalk; fragments of epidermis with a broadly elliptical stomata from 0.03 to 0.035 mm. in length and with 3 to 4 neighboring cells; fragments of tracheæ with simple or bordered pores and spiral or reticulate thickenings, also associated with sclerenchymatous fibers having thin porous walls and showing little or no lignification; pollen grains nearly smooth and from 0.035 to 0.05 mm. in diameter.

The presence of the leaves of *Hyoscyamus muticus* Linné in either the crude or powdered Hyoscyamus may be determined by the characteristic, branching, non-glandular hairs occurring on both the stems and leaves of that species.

Hyoscyamus yields not more than 30 per cent. of ash.

Assay.—Introduce 30 Gm. of Hyoscyamus, in No. 60 powder, into a 500-mil flask and add 300 mils of a mixture of 1 volume of chloroform and 2 volumes of ether. Stopper the flask, shake it well, and allow it to stand for ten minutes; then add 5 mils of ammonia water and shake the flask vigorously every ten minutes during two hours. Now add 40 mils of distilled water, again shake the flask and when the drug has settled decant 200 mils of the solution, representing 20 Gm. of Hyoscyamus, and proceed as directed under *Belladonnæ Radix*, page 1348, beginning with the word "Filter" on line six of the Assay. Before titration treat the residue twice with 5 mils of ether and evaporate to dryness each time.

Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 28.92 milligrammes of the total alkaloids of Hyoscyamus.

U. S. P. Preparations.—Extractum Hyoscyami; Fluidextractum Hyoscyami; Tinctura Hyoscyami.

N. F. Preparations.—Pilulæ Catharticæ Vegetabiles (from Extract); Pilulæ Colocynthidis et Hyoscyami (from Extract); Pilulæ Laxativæ Post Partum (from Extract).

Hyoscyamus contains *hyoscyamine,* $C_{17}H_{23}O_3N$, *hyoscine,* $C_{17}H_{21}ON_4$, *hyoscypicrin,* $C_{27}H_{52}O_{14}$, chlorophyll, mucilage, extractive, etc.

Uses.—Hyoscyamus is narcotic, hypnotic, and slightly laxative. Dose, four grains (0.25 Gm.).

HYOSCYAMINÆ HYDROBROMIDUM. U. S. Hyoscyamine Hydrobromide

[**Hyoscyamin. Hydrobr.**—Hyoscyamine Bromide]

The hydrobromide [$C_{17}H_{23}O_3N.HBr = 370.12$] of hyoscyamine, an alkaloid obtained from hyoscyamus and other plants of the *Solanaceæ.* Preserve it in well-closed containers, protected from light.

Preparation.—It is made by dissolving hyoscyamine in diluted hydrobromic acid, evaporating and crystallizing. This salt is somewhat more stable than the sulphate which was official in the U. S. P. VIII, but not included in the U. S. P. IX.

Official Description.—It occurs in white, prismatic crystals. It is deliquescent on exposure to the air. It dilates the pupil of the eye.

Odor, Taste, and Reaction.—Without odor. *Great caution must be observed in tasting it, using only a very dilute solution.* Its aqueous solution (1 in 20) is neutral to litmus, and is strongly lævorotatory.

Solubility.—One Gm. of Hyoscyamine Hydrobromide dissolves in 2.5 mils of alcohol, 1.7 mils of chloroform, and in 2260 mils of ether at 25° C. (77° F.); very soluble in water.

Test for Identity.—It melts at about 152° C. (305.6° F.).

Silver nitrate T.S., when added to an aqueous solution of the salt, yields a yellowish-white precipitate which is insoluble in nitric acid.

Shake 2 mils of chloroform with 1 mil of an aqueous solution of the salt (1 in 10) to which a few drops of chlorine water have been added; the chloroform assumes a brownish color.

No weighable ash remains on incinerating 0.1 Gm. of Hyoscyamine Hydrobromide.

Add about 0.01 Gm. of the salt to 5 drops of nitric acid, and evaporate to dryness in a porcelain dish; the residue yields a violet color upon the addition of alcoholic potassium hydroxide T.S.

Impurities and Tests for Impurities.—*Atropine and Scopolamine.*—Gold chloride T.S., when added to an aqueous solution of the salt (1 in 20), yields a precipitate which when recrystallized from a small quantity of boiling distilled water, acidulated with hydrochloric acid, is deposited on cooling in minute, lustrous, golden-yellow scales.

Most Alkaloids.—Platinic chloride T.S. does not form a precipitate in aqueous solutions of the salt (1 in 20).

Carbonizable Impurities.—About 0.05 Gm. of the salt dissolved in 1 mil of sulphuric acid gives not more than a faint yellow color.

Uses.—Hyoscyamine hydrobromide is used as a narcotic and sedative. The dose is one two-hundredth of a grain (0.0003 Gm.).

STRAMONIUM. U. S. Stramonium

[**Stramon.**—Jamestown Weed Jimson Weed]

The dried leaves of *Datura Stramonium* Linné, or of *Datura Tatula* Linné (Fam. *Solanaceæ*), without the presence or admixture of more than 10 per cent. of stems or other foreign matter, and yielding not less than 0.25 per cent. of the total alkaloids of Stramonium.

Official Description.—Usually much wrinkled and either loose or more or less matted together; laminæ when entire from 2 to 30 cm. in length, having petioles from 0.5 to 8 cm. in length; inequilaterally ovate, summits acute or acuminate, bases unequal, one side extending from 3 to 12 mm. below the other, margins sinuate, toothed or angled, the teeth being few, acute or acuminate and with rounded sinuses; frequently with numerous circular perforations which may have become filled with cork; upper surfaces dark green, sparsely hairy, especially upon the veins, lower surface light green. Stems cylindrical, usually flattened, attaining a length of 30 cm. and a diameter of 7 mm.; longitudinally wrinkled, occasionally with 1 or more deep furrows, light greenish-brown to purplish-brown.

Odor and Taste.—Odor distinct, heavy and narcotic; taste unpleasant, nauseous.

Tests for Identity and Purity.—The powder is brownish-green; upon clearing the fragments with hydrated chloral T.S. and examining under the microscope, it shows numerous elliptical stomata, about 0.025 mm. in length, and surrounded usually with 3 neighboring cells; cells of the mesophyll containing numerous small chloroplastids; calcium oxalate either in rosette aggregates, from 0.01 to 0.02 mm. in diameter, or in rod-like crystals, or in the form of sphenoidal micro-crystals; non-glandular hairs few, characteristic, 2- to 4-celled, attaining a length of 0.5 mm., the basal cell about 0.04 mm. in width, some of the cells more or less collapsed, the outer walls numerous, slight, centrifugal projections; glandular hairs few, with 1- to 2-celled stalks and usually 2- to 4-celled, glandular heads; tracheæ annular or spiral, fragments of the tracheal wall frequently detached. Stem fragments show large annular or spiral tracheæ which occasionally are thickened, with simple or bordered pores and associated with wood parenchyma; fragments with long, narrow unequally thickened collenchymatous cells; parenchyma with sphenoidal micro-crystals; wood-fibers occasional; bast-fibers absent.

Stramonium yields not more than 20 per cent. of ash.

Assay.—Proceed as directed under *Belladonnæ Radix*, page 1348, using 15 Gm. of Stramonium, in No. 60 powder, increasing the amount of water to be added after maceration to 25 mils, and, before titration, treating the final residue twice with 5 mils of ether, evaporating to dryness each time.

Each mil of tenth-normal sulphuric acid consumed corresponds to 28.92 milligrammes of the total alkaloids of Stramonium.

U. S. P. Preparations.—Extractum Stramonii (Pilular and Powdered); Tinctura Stramonii; Unguentum Stramonii (from Pilular Extract).

N. F. Preparation.—Fluidextractum Stramonii.

Stramonium contains *hyoscyamine, hyoscine,* and *atropine;* the mixed alkaloids were formerly called *daturine.* The leaves contain albumin, mucilage, malic acid, and potassium nitrate. In the seeds, which are no longer official, there is found about 25 per cent. of fixed oil, with resins, mucilage, etc.

Uses.—Stramonium is narcotic and poisonous. Dose, one to three grains (0.065 to 0.2 Gm.).

PILOCARPUS. U. S. Pilocarpus

[Pilocarp.—JABORANDI]

The dried leaflets of *Pilocarpus Jaborandi* Holmes, known in commerce as Pernambuco Jaborandi, or of *Pilocarpus microphyllus* Stapf, known in commerce as Maranham Jaborandi (Fam. *Rutaceæ*), without the presence or admixture of more than 5 per cent. of the stalks bearing the leaflets and stems of the same plant, or other matter, and yielding not less than 0.6 per cent. of the alkaloids of Pilocarpus.

Official Description.—Pernambuco Jaborandi.—Leaflets when entire, oval, oblong, or elliptical, from 4 to 10.5 cm. in length and from 2 to 4 cm. in breadth and with short, stout petiolules; summits more or less rounded or acute and emarginate; bases rounded or acute and mostly unequal; margins entire and narrowly revolute; very smooth, shiny, coriaceous and glandular-punctate; upper surfaces grayish to brownish-green, midribs mostly depressed, under surfaces yellowish- or greenish-brown and slightly pubescent on the prominent midvein.

Official Description.—Maranham Jaborandi.—Leaflets rhomboidally oval to obovate or elliptical, from 1.5 to 5 cm. in length and from 1 to 3 cm. in breadth, the lateral ones nearly sessile, the terminal ones on margined petiolules, from 0.5 to 1.5 cm. in length; of a nearly uniform grayish or yellowish-green color, rather thin but otherwise resembling Pernambuco Jaborandi.

Odor and Taste.—Peculiarly aromatic when crushed; taste bitterish, becoming somewhat pungent and having a sialagogue effect.

Tests for Identity and Purity.—Under the microscope, transverse sections of Pilocarpus show the upper epidermal cells with a yellowish layer of cutin from 0.005 to 0.01 mm. in thickness; palisade cells, 1 to 3 rows deep, being filled with chloroplastids; among the palisade cells occur large, nearly circular, oil-secretion reservoirs from 0.08 to 0.15 mm. in diameter; the dorsal pneumatic layer, from 10 to 20 rows in depth, the cells occasionally containing rosette aggregates of calcium oxalate from 0.01 to 0.025 mm. in diameter; distributed in the center of the leaf are the collateral fibro-vascular bundles, each surrounded by a more or less interrupted circle of several rows of thick-walled, slightly lignified bast-fibers; tracheæ associated with strongly lignified wood-fibers; among the cells of the lower epidermis occur numerous stomata. On surface view the stomata are broadly elliptical, from 0.025 to 0.04 mm. in length, being uniformly smaller in Maranham Jaborandi. Upon both surfaces of Pernambuco Jaborandi occur a number of non-glandular, one-celled hairs, more or less bent or curved, from 0.08 to 0.5 mm. in length, thick-walled and with numerous slight, centrifugal projections.

The powder is dark green or greenish-brown; epidermal cells on surface view 5- or 6-sided; stomata broadly elliptical, from 0.02 to 0.04 mm. in length, usually with four neighboring cells; fragments of fibro-vascular bundles showing tracheæ with simple or bordered pores or spiral thickenings, associated with thick-walled and strongly lignified wood-fibers; bast-fibers few, walls thick and only slightly lignified; calcium oxalate in rosette aggregates, from 0.01 to 0.025 mm. in diameter; fragments of laminæ showing large oil-secretion reservoirs and usually containing one or more globules of oil; non-glandular hairs having thick walls, usually more or less broken, are occasionally found.

Pilocarpus yields not more than 7 per cent. of ash.

Assay.—Introduce 15 Gm. of Pilocarpus in No. 60 powder, into a 250-mil flask, add 150 mils of chloroform and proceed as directed under *Belladonnæ Radix*, page 1348, second line of the assay, beginning with the word "Stopper," and decreasing the amount of water to be added after maceration to 5 mils. The 100 mils of chloroform solution must be drawn off from the bottom of the flask, and dissolve the alkaloids from the residue in 8 mils of tenth-normal sulphuric acid V.S.

Each mil of tenth-normal sulphuric acid V.S. corresponds to 20.8 milligrammes of the alkaloids of Pilocarpus.

U. S. P. Preparation.—Fluidextractum Pilocarpi.

Pilocarpus contains *pilocarpine*, $C_{11}H_{16}O_2N_2$, and *isopilocarpine. Jaborine,* which was believed to be a definite principle, has been shown to be a mixture of other alkaloids. It also contains a colorless, viscid oil. The leaves are coriaceous and difficult to powder.

Uses.—It is used as a diaphoretic and sialagogue. Dose, thirty grains (2 Gm.).

PILOCARPINÆ HYDROCHLORIDUM. U. S. Pilocarpine Hydrochloride

[Pilocarpin. Hydrochl.—PILOCARPINE CHLORIDE]

The hydrochloride [$C_{11}H_{16}O_2N_2.HCl = 244.62$] of an alkaloid obtained from pilocarpus. Preserve it in well-closed containers, protected from light.

Preparation.—Pilocarpine is added to diluted hydrochloric acid until it is neutralized, and the solution is then concentrated and crystallized.

Official Description.—It occurs in colorless, translucent crystals; hygroscopic on exposure to the air.

Odor, Taste, and Reaction.—Odorless and having a faintly bitter taste. Its aqueous solution (1 in 20) is neutral or at most only slightly acid to litmus.

Solubility.—One Gm. of Pilocarpine Hydrochloride dissolves in 0.3 mil of water, 3 mils of alcohol, and in 366 mils of chloroform at 25° C. (77° F.); also in 1.5 mils of alcohol at 60° C. (140° F.); insoluble in ether.

Tests for Identity.—When dried to constant weight at 100° C. (212° F.), it melts between 195° and 198° C. (383° and 388.4° F.).

Silver nitrate T.S. produces in an aqueous solution of the salt a white precipitate, insoluble in nitric acid.

No weighable ash remains on incinerating 0.1 Gm. of Pilocarpine Hydrochloride.

Impurities and Tests for Impurities.—*Other Alkaloids.*—Dissolve 0.01 to 0.02 Gm. of Pilocarpine Hydrochloride in 2 mils of distilled water in a test tube, add 2 mils of a slightly acid solution of hydrogen dioxide, and then cover the mixture with a small layer of benzene. Now add 3 or 4 drops of a solution of potassium dichromate (1 in

300) and shake the mixture gently; the benzene layer acquires a violet color, while the aqueous layer remains yellow. (If more than 0.02 Gm. of the salt is used, the benzene turns blue, and the reaction is no longer characteristic.)

Readily Carbonizable Impurities.—A solution of about 0.1 Gm. of the salt in 2 mils of sulphuric acid is colorless or at most only faintly yellow.

Various Foreign Alkaloids.—The addition of ammonia water or potassium dichromate T.S. to 10 mils of an aqueous solution of the salt (1 in 100) produces no turbidity.

Uses.—Pilocarpine hydrochloride is a diaphoretic and sialogogue, and is often used hypodermically. Dose, by mouth, one-sixth of a grain (0.01 Gm.); hypodermically, one-twelfth grain (0.005 Gm.).

PILOCARPINÆ NITRAS. U. S. Pilocarpine Nitrate
[Pilocarpin. Nit.]

The nitrate [$C_{11}H_{16}O_2N_2.HNO_3 = 271.17$] of an alkaloid obtained from pilocarpus. Preserve it in well-closed containers, protected from light.

Preparation.—Pilocarpine nitrate is made by adding pilocarpine to diluted nitric acid until neutralized, evaporating and crystallizing.

Official Description.—It occurs in shining crystals; permanent in the air.

Odor.—Odorless.

Solubility.—One Gm. of Pilocarpine Nitrate dissolves in 4 mils of water and in 75 mils of alcohol at 25° C. (77° F.); also in 21 mils of alcohol at 60° C. (140° F.); insoluble in chloroform or ether.

Tests for Identity.—It melts between 170° and 173° C. (338° and 343.4° F.).

Carefully pour an aqueous solution of the salt, mixed with an equal volume of ferrous sulphate T.S., over sulphuric acid without shaking; a brown ring appears at the juncture of the two layers.

Impurities and Tests for Impurities.—*Chloride.*—The addition of a few drops of silver nitrate T.S. to 5 mils of an aqueous solution of the salt (1 in 20), acidulated with nitric acid, produces not more than an opalescence.

In other respects the salt responds to the tests for identity and purity under *Pilocarpinæ Hydrochloridum.*

Uses.—Pilocarpine nitrate is used as a diaphoretic and sialogogue. The dose is the same as for the hydrochloride.

COLCHICI CORMUS. U. S. Colchicum Corm
[Colch. Corm.—Colchicum Root]

The dried corm of *Colchicum autumnale* Linné (Fam. *Liliaceæ*), yielding not less than 0.35 per cent. of colchicine.

Official Description.—Usually in reniform, transverse or in ovate, longitudinal slices; from 2 to 5 mm. in thickness; flat surfaces whitish, slightly roughened, and of a crystalline appearance under the hand lens; epidermis thin, light brown and finely wrinkled; fracture short and mealy.

Odor and Taste.—Odor slight; taste bitter and somewhat acrid.

Tests for Identity and Purity.—The powder is light brown or grayish-brown; starch grains numerous, single or 2- to 6-compound, the individual grains varying from spherical or ovoid to polygonal, and marked with a triangular or star-shaped, central cleft from 0.003 to 0.03 mm. in diameter; tracheæ few and with spiral or scalariform thickenings; occasional fragments of epidermal cells with thin, reddish-brown walls.

Colchicum Corm yields not more than 6 per cent. of ash.

Assay.—Proceed as directed under *Colchici Semen*, using 15 Gm. of Colchicum Corm.

U. S. P. Preparation.—Extractum Colchici Cormi.

N. F. Preparations.—Fluidextractum Colchici Cormi; Vinum Colchici Cormi.

Uses.—For uses see Colchicum Seed.

COLCHICI SEMEN. U. S. Colchicum Seed

[**Colch. Sem.**—Colchici Semen P. I.]

The dried seeds of *Colchicum autumnale* Linné (Fam. *Liliaceæ*), yielding not less than 0.45 per cent. of colchicine.

Official Description.—Ovoid or irregularly globular, more or less pointed at the hilum; from 2 to 3 mm. in diameter; when fresh, several seeds cohering; externally dark brown, finely pitted; tough and of almost bony hardness; internally whitish or light brown.

Odor and Taste.—Nearly inodorous; taste bitter and somewhat acrid.

Tests for Identity and Purity.—Under the microscope, transverse sections of Colchicum Seed show a seed-coat of a few more or less collapsed cells with thin reddish-brown walls; an endosperm, making up most of the seed, consisting of cells with rather thick, porous walls, the lamina containing oil globules and aleurone grains, the latter being from 0.003 to 0.015 mm. in diameter; a small embryo, the beaked portion, or caruncle, containing numerous, somewhat ovoid, ellipsoidal or polygonal starch grains, from 0.005 to 0.016 mm. in diameter.

Colchicum Seed yields not more than 8 per cent. of ash.

Assay.—Introduce 15 Gm. of Colchicum Seed, in No. 60 powder, into a 500-mil flask, and add 10 mils of solution of lead subacetate and 290 mils of distilled water. Weigh the flask and contents, and digest the mixture at from 60° to 70° C. (140° to 158° F.) for three hours, with occasional agitation. Cool, add distilled water to restore the original weight and filter off 200 mils. Add 0.75 Gm. of sodium phosphate to the clear filtrate, shake the mixture frequently during half an hour, and filter off 100 mils representing 5 Gm. of Colchicum Seed. Shake out the alkaloid from the filtrate with chloroform until completely extracted, as shown by testing with iodine T.S. (in place of the usual mercuric potassium iodide T.S.), and evaporate the chloroform solution; add about 1 mil of alcohol and again evaporate. Repeat this operation once more and dry the residue to constant weight at 100° C. (212° F.). To this weighed residue contained in a flask add 5 mils of tenth-normal sulphuric acid V.S. and 5 mils of distilled water and heat the mixture for ten minutes at 70° C. (158° F.). Now filter the liquid through a pledget of purified cotton, wash the flask and cotton with distilled water, reject the filtrate and washings and remove as much of the water from the cotton as possible. Dissolve any insoluble residue that may remain on the cotton by washing it first with a little alcohol and then with ether; collect the alcohol-ether washings in the flask, evaporate, and dry the residue to constant weight at 100° C. (212° F.). Deduct this weight from the weight of the residue previously obtained. The difference will be the weight of colchicine obtained from 5 Gm. of Colchicum Seed (see Proximate Assays, Chapter LXII).

U. S. P. Preparations.—Fluidextractum Colchici Seminis; Tinctura Colchici Seminis.

N. F. Preparation.—Vinum Colchici Seminis (from Fluidextract).

The alkaloid *colchicine*, $C_{22}H_{15}O_6N$, is found in both the corm and seed of colchicum. It is the active principle. There are present in the corm, starch, gum, fat, sugar, resin, etc. In the seed, a fixed oil is found in addition to the other principles. The toughness of the seeds is due to their composition and structure, being composed chiefly of horny albumin made up of cells having very thick walls and surrounded by a closely adherent testa. The seeds may be exhausted of their active principle by digesting them in hot alcohol without bruising or powdering them.

Uses.—Colchicum is used in gout and rheumatism. Dose, of the seeds, three grains (0.2 Gm.); of the corm, four grains (0.25 Gm.).

COLCHICINA. U. S. Colchicine

An alkaloid [$C_{22}H_{25}O_6N = 399.21$] obtained from colchicum. Preserve it in well-closed containers, protected from light.

Preparation.—Colchicine may be made by percolating colchicum with alcohol, evaporating the percolate, diluting with water, filtering, precipitating the coloring matter with lead subacetate, treating the liquid with sodium phosphate to separate lead compounds, and precipitating the colchicine with tannic acid; the tannate is then digested with lead oxide, dried, and the colchicine dissolved out with alcohol.

Official Description.—It occurs in pale yellow, amorphous scales, or as a pale yellow amorphous powder, turning darker on exposure to light.

Odor, Taste and Reaction.—Odorless or nearly so. *Great caution must be used in tasting it, and then only in very dilute solutions.* Its aqueous solution (1 in 30) is neutral to litmus, and is lævorotatory.

Solubility.—One Gm. of Colchicine dissolves in 22 mils of water, 220 mils of ether and in 100 mils of benzene at 25° C. (77° F.); also in 21 mils of water at 80° C. (176° F); freely soluble in alcohol or chloroform; insoluble in petroleum benzin.

Tests for Identity.—An aqueous solution is of a yellow color, which is intensified by the addition of mineral acids.

It melts between 142° and 146° C. (287.6° and 294.8° F.).

Stir about 0.001 Gm. of Colchicine with a few drops of sulphuric acid; a lemon-yellow color is produced, which, on the addition of a drop of nitric acid, changes to greenish-blue, then to red and finally to yellow. On adding an excess of potassium hydroxide T.S., the color is changed to red.

No weighable ash remains on incinerating 0.1 Gm. of Colchicine.

Impurities and Tests for Impurities.—*Colchicine.*—The addition of 2 drops of ferric chloride T.S. to 5 mils of an aqueous solution of Colchicine (1 in 100) produces no color, but, on heating, a brownish-red color is developed, which changes to brownish-black; 1 drop of ferric chloride T.S. added to 1 mil of an alcoholic solution of Colchicine (1 in 20) produces a garnet-red color at once.

Chloroform.—Heat a mixture of about 0.01 Gm. of Colchicine, 2 mils of potassium hydroxide T.S., and 1 drop of aniline; no odor of phenylisocyanide develops.

Uses.—Colchicine is used in the treatment of gout and rheumatism. Dose, one hundred and twentieth of a grain (0.0005 Gm.).

VERATRUM VIRIDE. U. S. Veratrum Viride

[Verat. Vir.—Green Hellebore American Hellebore]

The dried rhizome and roots of *Veratrum viride* Aiton (Fam. *Liliaceæ*), without the presence or admixture of more than 5 per cent. of stems or other foreign matter.

Official Description.—Rhizome upright, obconical, usually cut longitudinally into 2 to 4 pieces, from 2 to 7 cm. in length and from 1.5 to 3 cm. in diameter, externally light brown to dark brown or brownish-black, frequently bearing at the summit numerous, closely arranged, thin leaf-bases, otherwise rough and wrinkled, somewhat annulate from scars of bud-scales and bearing in the outer portion numerous roots, the lower part more or less decayed; fracture hard and horny; internally yellowish or grayish-white, marked with numerous, irregular fibro-vascular bundles.

Odor and Taste.—Inodorous but sternutatory; taste bitter and acrid.

Roots nearly cylindrical, from 3 to 8 cm. in length and from 1 to 3 mm. in diameter, externally light brown to yellowish-brown, deeply transversely wrinkled; fracture short, bark whitish, very thick, enclosing a porous central cylinder.

Tests for Identity and Purity.—The powder is grayish-brown to dark brown, strongly sternutatory; under the microscope it exhibits numerous starch grains from 0.003 to 0.02 mm. in diameter, spherical or ellipsoidal, single or 2- to 3-compound, the individual grains being often swollen or otherwise more or less altered; calcium oxalate in rhaphides, from 0.015 to 0.15 mm. in length; fragments with tracheæ, the walls being more or less strongly lignified and marked with scalariform or reticulate thickenings, frequently containing a lemon-yellow substance and associated with narrow, slightly lignified, porous, sclerenchymatous fibers; reddish-brown or brownish-black cork fragments occasional.

U. S. P. Preparations.—Fluidextractum Veratri Viridis; Tinctura Veratri Viridis.

The U. S. P. VIII included under the name of Veratrum both Veratrum album and Veratrum viride, but, as the two drugs do not possess identical therapeutic value, the U. S. P. IX recognizes only the latter as official.

Veratrum viride contains the alkaloids *jervine, pseudojervine, rubijervine, protoveratrine,* and *protoveratridine.* The most active of these appears to be protoveratrine, which is very poisonous and sternutatory. It also contains a bitter glucoside *veratramarin* and *jervic acid,* and it is claimed that *cevadine* is present in veratrum viride but not in veratrum album, while the other constituents are present in both. It was supposed for many years to owe its activity to veratrine. There are also present resins, starch, coloring matter, etc.

Uses.—It is a cardiac sedative, poisonous, with emetic and diaphoretic properties. Dose, one to two grains (0.065 to 0.13 Gm.).

VERATRINA. U. S. Veratrine
[Veratrin.—VERATRIA]

A mixture of alkaloids obtained from the seed of *Asagræa officinalis* (Chamisso and Schlechtendal) Lindley (Fam. *Liliaceæ*). Preserve it in well-closed containers, protected from light.

Preparation.—The seeds are exhausted with alcohol, and the alcohol recovered by distillation. The residuary liquid contains veratrine in its natural combination with veratric acid; this is diluted with water (which precipitates the resins) and filtered; potassium hydroxide or ammonia is added to the filtrate, when veratrine is precipitated. It is then redissolved, decolorized, and reprecipitated.

Official Description.—It is a white, or grayish-white, amorphous powder. It is slightly hygroscopic.

Odor, Taste, and Reaction.—Odorless, but causing intense irritation and sneezing when even a minute quantity reaches the nasal mucous membrane. *Great caution must be used in tasting it.* Its alcoholic solution is alkaline to moistened litmus paper.

Solubility.—One Gm. of Veratrine dissolves in 1760 mils of water, 2.8 mils of alcohol, 0.7 mil of chloroform, and in 4.2 mils of ether at 25° C. (77° F.); also in 1345 mils of water at 80° C. (176° F.); insoluble in petroleum benzin.

Tests for Identity.—Triturate about 0.05 Gm. of Veratrine with 2 mils of sulphuric acid in a glass mortar; the yellow or orange-red solution exhibits by reflected light a greenish fluorescence, which becomes more intense upon the addition of an equal volume of sulphuric acid. Upon standing, the solution gradually assumes a deep red color.

Sulphuric acid, when heated with Veratrine, gives a cherry-red color. Sulphuric acid added to a mixture of one part of Veratrine and six parts of sugar produces a green color, which changes to blue, and finally the mixture becomes colorless.

No weighable ash remains on incinerating 0.1 Gm. of Veratrine.

Impurities and Test for Impurities.—*Various Foreign Alkaloids.*—An alc solution of Veratrine (1 in 20) remains clear after the addition of platinic chlorid

N. F. Preparations.—Oleatum Veratrinæ; Unguentum Veratrinæ.

Uses.—Veratrine is used externally, in neuralgia, rheumatism, It is sternutatory and very poisonous.

SANGUINARIA. U. S. Sanguinaria
[Sanguin.—BLOOD ROOT]

The dried rhizome and roots of *Sanguinaria canadensis* Li (Fam. *Papaveraceæ*).

Official Description.—Of horizontal growth, occasionally branching, more or cylindrical, somewhat flattened, from 2 to 7 cm. in length, and from 5 to 15 m diameter; externally dark brown, slightly annulate, with a few stem scars on the upper surface and numerous more or less broken filiform roots and root scars on the lower surface; fracture short and somewhat waxy, brownish-red, occasionally yellowish-white, with numerous small, circular, yellowish fibro-vascular bundles within about 1 mm. of the epidermis, pith very large.

Odor and Taste.—Odor slight; taste persistently acrid and bitter.

Tests for Identity and Purity.—Under the microscope, transverse sections of the rhizome of Sanguinaria show an outer layer of a single row of thin-walled epidermal cells; a cortex of from 10 to 15 rows of thin-walled parenchyma cells containing numerous starch grains, or a small amount of a fixed oil; a zone of cambium, most of which is interfascicular; a narrow circular zone of small collateral fibro-vascular bundles, separated from each other by parenchyma; pith large, consisting of starch-bearing parenchyma cells; latex cells containing a red or orange-colored secretion, either isolated or connected into irregular chains and distributed among the parenchymatous cells of the middle bark and pith; sections treated with gylcerin show in the secretion cells, after twenty-four hours, spheroidal aggregates of crystals which strongly polarize light.

The powder is brownish-red, sternutatory; when examined under the microscope it exhibits numerous starch grains, from 0.003 to 0.02 mm. in diameter, being mostly single, seldom 2- to 3-compound, the individual grains nearly spherical or ovoid, sometimes more or less plano-convex, somewhat resembling those of wheat starch in outline but polarizing light more strongly; numerous fragments of short latex cells with reddish-brown resinous masses; tracheal fragments few, having numerous slit-like pores.

U. S. P. Preparation.—Tinctura Sanguinariæ.

N. F. Preparations.—Fluidextractum Sanguinariæ; Syrupus Pini Strobi Compositus; Syrupus Pini Strobi Compositus cum Morphina; Syrupus Sanguinariæ.

Sanguinaria contains *sanguinarine*, $C_{20}H_{15}O_4N + H_2O$, a colorless alkaloid, which yields bright red salts. Other alkaloids are present, *chelerythrine, fumarine,* and *homochelidonine.* It also contains malic and citric acids, starch, resins, coloring matter, etc. The liquid preparations invariably deposit a reddish precipitate upon the sides of the bottle.

Uses.—It is alterative, sternutatory, stimulant, and emetic. The dose is two to ten grains (0.13 to 0.65 Gm.).

STAPHISAGRIA. U. S. Staphisagria
[Staphisag.—STAVESACRE]

The ripe seeds of *Delphinium Staphisagria* Linné (Fam. *Ranunculaceæ*), without the presence or admixture of more than 2 per cent. of foreign vegetable matter.

Official Description.—Irregularly triangular, flattened, or somewhat tetrahedral, one side being convex, from 4 to 7 mm. in length and from 3 to 6 mm. in breadth; externally dark brown, becoming lighter with age, and coarsely reticulate; easily cut, showing a somewhat light brown, oily endosperm, enclosing a small embryo at the pointed end.

Odor and Taste.—Odor slight, disagreeable; taste intensely bitter and acrid.

Tests for Identity and Purity.—Under the microscope, transverse sections of Staphisagria show an outer layer of nearly tabular, thick-walled, non-lignified cells, some being extended centrifugally, and forming the reticulations of the seed-coat; 2 or 3 rows of parenchyma cells with more or less irregular thin walls; a thin layer of very small [illegible]-walled cells with numerous, lattice-like or reticulate pores; endosperm large, composed of polygonal cells enclosing small aleurone grains and fixed oil, the latter forming large globules on the addition of hydrated chloral T.S.

U. S. P. Preparation.—Fluidextractum Staphisagriæ.

Staphisagria contains three alkaloids, *delphinine*, $C_{31}H_{49}O_7N$, *delphisine,* and *delphinoidine. Staphisagrine, staphisagroine,* and *cal[illegible]rapine* are also present, with fixed oil, protein compounds, mucilage, etc. The alkaloids are soluble in chloroform, fixed oils, alcohol, and ether, and an oleoresin made with petroleum benzin is a good preparation.

Uses.—It is used principally externally, for killing body vermin, the [illegible] is very poisonous. Dose, one grain (0.065 Gm.).

ACONITUM. U. S. Aconite

[Aconit.—MONKSHOOD ACONITE ROOT ACONITI TUBER P. I.]

The dried tuberous roots of *Aconitum Napellus* Linné (Fam. *Ranunculaceæ*), without the presence or admixture of more than 5 per cent. of stems or other foreign matter, and yielding not less than 0.5 per cent. of the ether-soluble alkaloids of Aconite. If made into a fluidextract and assayed biologically the minimum lethal dose should not be greater than 0.00004 mil for each gramme of body weight of guinea-pig.

Official Description.—More or less conical or fusiform, from 4 to 10 cm. in length and from 1 to 2 cm. in diameter at the crown; externally dark brown or grayish-brown, smooth or longitudinally wrinkled, the upper end with a bud, remains of bud-scales or stem scars, the other portions with numerous root scars or short rootlets; fracture short, horny or somewhat mealy; internally, bark light or dark brown 1 to 2 mm. in thickness, cambium zone usually 5- to 8-angled, with a small fibro-vascular bundle in each angle, pith whitish or light brown, from 2 to 7 mm. in diameter.

Odor and Taste.—Odor very slight; taste sweetish, soon becoming acrid and developing a tingling sensation, followed by numbness.

Tests for Identity and Purity.—Under the microscope, transverse sections, made near the middle of the tuberous root of Aconite, show an outer layer consisting of one or more rows of cells with blackish-brown walls; a primary cortex of 8 to 15 rows of parenchymatous cells and interspersed with characteristic stone cells, which occur either singly or in small groups; a more or less modified endodermis; a secondary cortex, consisting chiefly of starch-bearing parenchyma and interspersed with a few small fibro-vascular bundles; a more or less star-shaped and characteristic cambium with from 5 to 12 collateral fibro-vascular bundles; and a pith composed of large, starch-bearing parenchyma cells.

The powder is grayish-brown; starch grains numerous, spherical, somewhat plano-convex, single or 2- to 5-compound, the individual grains from 0.003 to 0.015 mm. in diameter and frequently with a central cleft; tracheæ mostly with slit-like, simple pores, sometimes with spiral or reticulate thickenings or with bordered pores; stone cells single, tabular, irregular in shape or elongated to fibers, from 0.1 to 0.4 mm. in length, walls from 0.008 to 0.025 mm. in thickness, strongly lignified and having large, simple pores; fragments of cork few, yellowish-brown; fragments of parenchyma numerous, the cells being filled with starch grains; bast-fibers from stems few, very long, with lignified walls about 0.005 mm. in thickness, and marked by transverse or oblique, slit-like pores.

Aconite yields not more than 6 per cent. of ash.

Assay.—Proceed as directed under *Belladonnæ Radix* (page 1348), using 15 Gm. of Aconite in No. 40 powder and ether only as the immiscible solvent throughout the assay.

Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 64.539 milligrammes of the ether-soluble alkaloids of Aconite.

For an alternative method of assaying Aconite see Biological Assays (Chapter LXII).

U. S. P. Preparations.—Extractum Aconiti; Fluidextractum Aconiti; Tinctura Aconiti.

N. F. Preparation.—Linimentum Aconiti et Chloroformi (from Fluidextract).

Aconite contains *aconitine,* $C_{34}H_{47}O_{11}N$, which is the most important constituent. *Benzaconine* and *aconine* are derivative alkaloids which have been shown to be present. *Napelline,* another derivative, has also been reported. Aconitine is readily decomposed into the other alkaloids which are inert or less active and for this reason the U. S. P. IX has added a biological standard for the drugs and its preparations to indicate the minimum activity, while the chemical assay places a check upon the maximum strength. *Aconitic acid,* $H_6C_6O_6$, is also present, together with resins, sugar, fat, coloring matter, etc. Aconitic acid may be produced by heating citric acid to 155° C. (311° F.). Alcohol is the best menstruum for preparations of aconite.

Uses.—Aconite is a cardiac and nerve sedative, producing numbness and tingling when applied to the tongue or lips. It is very poisonous. Dose, one-half grain (0.032 Gm.).

ACONITINA. U. S. Aconitine

[Aconitin.]

An alkaloid [$C_{34}H_{47}O_{11}N = 645.39$] obtained from aconite. Preserve it in well-closed containers, protected from light.

Preparation.—Aconitine may be made by acidifying an alcoholic tincture of aconite with tartaric acid to remove resin and fatty matter, precipitating the filtrate with sodium bicarbonate, dissolving the precipitate in ether, and crystallizing.

Official Description.—It occurs in colorless or white rhombic tables or prisms; permanent in the air.

Odor, Taste, and Reaction.—Possessing no odor. *The alkaloid itself must never be tasted, and its solutions only when largely diluted, and then with the utmost caution.* A drop of an aqueous solution of the alkaloid or its salts (1 in 100,000), placed upon the tongue, produces a tingling and numbing sensation. Aconitine solutions are alkaline to litmus.

Solubility.—One Gm. of Aconitine dissolves in 28 mils of alcohol, about 65 mils of ether, and in 7 mils of benzene, at 25° C. (77° F.); very slightly soluble in water and almost insoluble in petroleum benzin at 25° C. (77° F.).

Tests for Identity.—When heated rapidly, Aconitine melts at about 195° C. (383° F.).

Stir about 0.001 Gm. of Aconitine with 2 or 3 drops of nitric or sulphuric acid on a white porcelain surface; it dissolves without coloration. With 2 drops of sulphuric acid containing 0.005 Gm. of ammonium vanadate in each mil an orange color is produced under the same conditions.

Dilute solutions of Aconitine salts yield precipitates with mercuric potassium iodide T.S., tannic acid T.S., or gold chloride T.S., but only concentrated solutions yield precipitates with platinic chloride T.S., mercuric chloride T.S., or picric acid T.S.

No weighable ash remains on incinerating 0.05 Gm. of Aconitine.

Impurities and Tests for Impurities.—*Pseudaconitine or Atropine.*—Evaporate a solution of 0.01 Gm. of Aconitine to dryness, add 5 drops of fuming nitric acid; evaporate again to dryness; the resulting yellow residue, when cooled, yields no violet color when treated with alcoholic potassium hydroxide T.S.

N. F. Preparation.—Oleatum Aconitinæ.

Uses.—*Crystallized* aconitine is a *very powerful poison.* It is given in the dose of one four-hundredth of a grain (0.00015 Gm.). Amorphous or commercial aconitine is usually an impure product. It is a cardiac and nerve sedative.

HYDRASTIS. U. S. Hydrastis

[GOLDEN SEAL]

The dried rhizome and roots of *Hydrastis canadensis* Linné (Fam. *Ranunculaceæ*), without the presence or admixture of more than 2 per cent. of the stems, leaves or other foreign matter and yielding not less than 2.5 per cent. of the ether-soluble alkaloids of Hydrastis.

Official Description.—Rhizome horizontal or oblique, sub-cylindrical and usually more or less flexuous, from 1 to 5 cm. in length and from 2 to 7 mm. in diameter, occasionally with stem-bases; externally yellowish or grayish-brown, marked by numerous stem scars and more or less annulate from scars of bud-scales, otherwise deeply longitudinally wrinkled; on the under and lateral portions arise numerous, long, filiform roots which are easily detached; fracture short, waxy; internally of a deep yellow color and consisting mostly of parenchyma enclosing an interrupted circle of small fibrovascular bundles.

Odor and Taste.—Odor distinctive; taste bitter.

Tests for Identity and Purity.—Macerate the drug for a short time in water until it is softened, then make sections and mount then directly in sulphuric acid and examine under the microscope; in a short time numerous acicular or rod-shaped crystals separate, some attaining a length of 0.2 mm.

The powder is brownish-yellow; starch grains numerous, from 0.002 to 0.015 mm. in diameter, mostly single, nearly spherical, and either free or in the parenchyma cells:

fragments with the tissues of the fibro-vascular bundles mostly associated with starch-bearing parenchyma; tracheæ with simple and bordered pores and occasionally spiral thickenings, and associated with short sclerenchymatous fibers possessing thin walls with simple pores; occasional fragments of tabular cork cells with reddish-brown walls.

Assay.—Introduce 10 Gm. of Hydrastis, in No. 60 powder, into a 250-mil flask and add 100 mils of ether and proceed as directed under *Belladonnæ Radix*, page 1348, second line of the Assay, beginning with the word "Stopper." Modify the process there given by using 50 mils of the ether solution, representing 5 Gm. of Hydrastis, to complete the assay. Use ether instead of chloroform for the final shaking out of the alkaloids and dry the residue to constant weight at 100° C. (212° F.) instead of titrating. The weight is the amount of ether-soluble alkaloids from 5 Gm. of Hydrastis.

U. S. P. Preparations.—Extractum Hydrastis; Fluidextractum Hydrastis; Glyceritum Hydrastis; Tinctura Hydrastis.

N. F. Preparation.—Mistura Rhei Alkalina (from Fluidextract).

Hydrastis contains *hydrastine*, $C_{21}H_{21}O_6N$, *berberine*, $C_{20}H_{17}O_4N$, and *canadine*, $C_{20}H_{21}O_4N$, sugar, starch, resin, coloring matter, etc. The salts of hydrastine are white; those of berberine are bright yellow.

Uses.—Hydrastis is used as an alterative and tonic, in doses of twenty to forty grains (1.3 to 2.6 Gm.).

HYDRASTINA. U. S. Hydrastine

An alkaloid [$C_{21}H_{21}O_6N = 383.18$] obtained from hydrastis or prepared synthetically. Preserve it in well-closed containers, protected from light.

Preparation.—Hydrastine is made by adding hydrochloric or sulphuric acid to an alcoholic tincture of hydrastis; the berberine is deposited as a crystalline precipitate, ammonia is added to the filtered mother liquor, and the precipitated hydrastine is purified by recrystallization.

Official Description.—It occurs in white to creamy white, glistening prisms or as a white, micro-crystalline powder; permanent in the air.

Reaction.—Its saturated alcoholic solution is alkaline to litmus.

Solubility.—Hydrastine is almost insoluble in water; 1 Gm. is soluble in 170 mils of alcohol, 1.4 mils of chloroform, and in 175 mils of ether at 25° C. (77° F.); also in 22 mils of alcohol at 60° C. (140° F.); freely soluble in benzene.

Tests for Identity.—It melts at about 131° C. (267.8° F.).

Sulphuric acid produces a yellow color when added to Hydrastine; on heating the mixture, a purple color develops.

Sulphuric acid containing 0.005 Gm. of molybdic acid in each mil gives with Hydrastine a green color, changing to olive-green and then to brown; nitric acid yields a reddish-yellow color; sulphuric acid containing 0.005 Gm. of selenous acid in each mil gives a light green color, changing to brown.

No weighable ash remains on incinerating 0.1 Gm. of Hydrastine.

Impurities and Tests for Impurities.—*Hydrastinine.*—A solution of about 0.1 Gm. of Hydrastine in 10 mils of diluted sulphuric acid shows no blue fluorescence, but on the gradual addition of potassium permanganate T.S., avoiding excess, a blue fluorescence develops.

Berberine.—An aqueous solution of Hydrastine (1 in 20), made with the aid of a slight excess of diluted hydrochloric acid, is not reddened by chlorine water.

Uses.—Hydrastine is used as an alterative, tonic, and stimulant. Dose, one-sixth of a grain (0.01 Gm.).

HYDRASTINÆ HYDROCHLORIDUM. U. S. Hydrastine Hydrochloride

[**Hydrastin. Hydrochl.**—Hydrastine Chloride]

The hydrochloride [$C_{21}H_{21}O_6N.HCl = 419.65$] of the alkaloid hydrastine. Preserve it in well-closed containers, protected from light.

Preparation.—It may be made by adding hydrochloric acid carefully to hydrastine in aqueous mixture until a neutral solution results, then concentrating and crystallizing.

Official Description.—It occurs as a white to creamy-white powder; hygroscopic.

Odor and Reaction.—Odorless. An aqueous solution of the salt (1 in 20) is neutral or only slightly acid to litmus.

Solubility.—Hydrastine Hydrochloride is very soluble in water and in alcohol; slightly soluble in chloroform; very slightly soluble in ether.

Tests for Identity.—An aqueous solution of the salt (1 in 20) yields with silver nitrate T.S. a white precipitate, insoluble in nitric acid.

Impurities and Tests for Impurities.—In other respects the salt responds to the tests for identity and purity under *Hydrastina*, omitting the melting point.

Uses.—Same uses and dose as hydrastine.

HYDRASTININÆ HYDROCHLORIDUM. U. S. Hydrastinine Hydrochloride

[**Hydrastinin. Hydrochl.**—Hydrastinine Chloride]

The hydrochloride [$C_{11}H_{11}O_2N.HCl = 225.57$] of hydrastinine, an alkaloid obtained by the oxidation of hydrastine. Preserve it in well-closed containers, protected from light.

Preparation.—This is the hydrochloride of an artificial alkaloid, *hydrastinine,* $C_{11}H_{11}O_2N$, made by acting on colorless hydrastine with oxidizing agents.

Official Description.—It occurs in light yellowish needles, or as a yellowish-white, crystalline powder.

Odor and Reaction.—Without odor. Its aqueous solution (1 in 20) is neutral to litmus and shows a blue fluorescence, especially when highly diluted.

Solubility.—One Gm. of Hydrastinine Hydrochloride dissolves in 195 mils of chloroform, and in 1820 mils of ether at 25° C. (77° F.); very soluble in water and alcohol.

Tests for Identity.—It melts at about 210° C. (410° F.) with partial decomposition.

In an aqueous solution of the salt (1 in 20), potassium dichromate T.S. produces a precipitate which redissolves if gently heated, but on cooling the solution it separates again in glistening needles.

Silver nitrate T.S. produces in an aqueous solution of the salt a white precipitate, insoluble in nitric acid.

No weighable ash remains on incinerating 0.1 Gm. of Hydrastinine Hydrochloride.

Impurities and Tests for Impurities.—*Hydrastine.*—In an aqueous solution of the salt (1 in 20), bromine T.S. produces a yellow precipitate, which is completely soluble in ammonia water, producing an almost colorless solution.

Foreign Alkaloids.—Add slowly 4 or 5 drops of a solution of sodium hydroxide (1 in 7) to a solution of 0.2 Gm. of the salt in 3 mils of distilled water; each drop causes a milky turbidity, which disappears again on shaking. From this solution, after standing for some time, pure white hydrastinine separates, and the supernatant fluid is almost colorless. Add a few drops of ammonia water to 1 mil of an aqueous solution of Hydrastinine Hydrochloride (1 in 20); no turbidity is produced.

N. F. Preparation.—Liquor Hydrastinæ Compositus.

Uses.—Hydrastinine hydrochloride is an oxytocic, in doses of one-half to one grain (0.032 to 0.065 Gm.).

LIQUOR HYDRASTINÆ COMPOSITUS. N. F. Compound Solution of Hydrastine

[**Liq. Hydrastin. Co.**—COLORLESS HYDRASTINE SOLUTION]

	Metric	Old form
Hydrastine Hydrochloride	**3 Gm.**	**21 gr.**
Aluminum Chloride	**3 Gm.**	**21 gr.**
Calcium Chloride	**3 Gm.**	**21 gr.**
Magnesium Chloride	**3 Gm.**	**21 gr.**
Potassium Chloride	**1 Gm.**	**7 gr.**
Glycerin	**500 mils**	**8 fl. oz.**
Distilled water, a sufficient quantity		
To make	**1000 mils**	**16 fl. oz.**

Dissolve the salts in 450 mils [old form 7 fluidounces 96 minims] of distilled water, add the glycerin, filter and add sufficient distilled water to make the product measure 1000 mils [old form 16 fluidounces].

Uses.—It is used as an alterative, astringent, and antiseptic in a dose of one fluidrachm (4 mils).

GRANATUM. U. S. Pomegranate

[**Granat.**—POMEGRANATE BARK]

The dried bark of the stems and roots of *Punica Granatum* Linné (Fam. *Punicaceæ*), without the presence or admixture of more than 2 per cent. of wood or other foreign matter. Preserve it in tightly-closed containers.

Official Description.—The stem bark is mostly in somewhat flattened or transversely curved pieces, to some extent in quills, from 2 to 8 cm. in length; bark from 0.5 to 3.5 mm. in thickness; outer surface yellowish to grayish-brown, with grayish patches of foliaceous lichens with their brownish-black apothecia, longitudinally wrinkled, also marked with small, broadly elliptical lenticels and with more or less abraded patches of cork; inner surface light yellow or yellowish-brown, finely striate; fracture short, smooth, inner bark yellowish-green.

Odor and Taste.—Odor slight; taste astringent, somewhat bitter and nauseous.

Tests for Identity.—The root bark is in transversely curved pieces; externally brownish-yellow to dark brown with irregular patches of cork; internally dark yellow, the medullary rays extending nearly to the outer surface.

The powder is yellowish-brown to dark brown; calcium oxalate crystals in rosette aggregates, monoclinic prisms or crystal fibers, the individual crystals from 0.01 to 0.018 mm. in diameter; starch grains numerous, spherical, ellipsoidal biconvex, polygonal or irregular, and single or compound, from 0.002 to 0.01 mm. in diameter; fragments of whitish cork with strongly lignified walls; stone cells mostly single, occasionally in small groups, the individual cells from 0.05 to 0.18 mm. in length, the walls being very thick and strongly lamellated; occasional fragments of wood with long wood-fibers from 0.015 to 0.02 mm. in width, the walls being slightly lignified and from 0.003 to 0.008 mm. in thickness and associated with tracheæ possessing simple and bordered pores.

Mix 1 Gm. of powdered Pomegranate with 100 mils of distilled water, macerate it with occasional agitation for about an hour and filter; a light yellow filtrate is obtained. Upon the addition of a drop of ferric chloride T.S. to 10 mils of this filtrate a bluish-black precipitate is produced. Upon the addition of from 40 to 50 mils of lime water to another portion of 10 mils of the filtrate, an orange-brown, flocculent precipitate is produced.

Pomegranate yields not more than 16 per cent. of ash.

U. S. P. Preparation.—Fluidextractum Granati.

Pomegranate contains four alkaloids, *pelletierine*, $C_8H_{15}ON$, *isopelletierine*, *methylpelletierine*, *pseudopelletierine* (or *granatonine*). The first named is sometimes called *punicine;* the mixed alkaloids are official in the form of pelletierine tannate; pseudopelletierine is solid and crystallizable; the others are liquid. It also contains punicotannic acid, $C_{20}H_{16}O_{13}$, sugar, mannite, pectin, gum, etc.

Uses.—Pomegranate is anthelmintic, in doses of thirty grains (2 Gm.).

PELLETIERINÆ TANNAS. U. S. **Pelletierine Tannate**

[Pellet. Tann.]

A mixture in varying proportions of the tannates of four alkaloids (punicine, iso-punicine, methyl-punicine, and pseudo-punicine), obtained from pomegranate. Preserve it in small, well-closed containers, protected from light.

Preparation.—Pelletierine tannate may be made by precipitating a solution of a sulphate of the alkaloids from pomegranate bark with a solution of tannic acid containing ammonia, washing and drying the precipitate.

Official Description.—It is a light yellow, amorphous powder.

Odor, Taste, and Reaction.—Odorless, having an astringent taste, and a weak acid reaction.

Solubility.—One Gm. of Pelletierine Tannate dissolves in 240 mils of water, 16 mils of alcohol, and in 420 mils of ether at 25° C. (77° F.); dissolved by warm dilute acids; insoluble in chloroform.

Tests for Identity.—Ferric chloride T.S. colors aqueous solutions of the salt blue black.

No weighable ash remains on incinerating 0.2 Gm. of Pelletierine Tannate.

Dissolve about 0.5 Gm. of Pelletierine Tannate, accurately weighed, in 5 mils of potassium hydroxide T.S. and shake the solution in a separator with 10 mils of chloroform and then with two or more successive portions of 5 mils each of chloroform. Acidulate the combined chloroform solutions with 0.1 mil of hydrochloric acid, evaporate it to apparent dryness, dissolve the residue in 5 mils of alcohol, again evaporate, and dry for one hour at 60° C. (140° F.). The weight of residue so obtained corresponds to not less than 20 per cent. of the weight taken.

The residue obtained in the preceding test responds to the following tests for identity and purity:

Stir about 0.001 Gm. of the residue on a white porcelain surface with 2 drops of sulphuric acid containing 0.005 Gm. of selenous acid in each mil, and warm the mixture; a light bluish-green color is produced which gradually changes to dark green.

Stir about 0.001 Gm. of the residue on a white porcelain surface with 2 drops of sulphuric acid or nitric acid; no color other than a light yellow is produced.

Impurities and Test for Impurities.—*Foreign Alkaloids.*—Platinic chloride T.S. produces no precipitate in a cold solution of about 0.1 Gm. of Pelletierine Tannate in a mixture of 4 mils of distilled water and 1 mil of diluted hydrochloric acid.

Uses.—Pelletierine tannate is used as a tænifuge. Dose, four grains (0.25 Gm.).

IPECACUANHA. U. S. **Ipecac**

[Ipecac.—Ipecacuanhæ radix **P. I.]**

The dried root of *Cephaelis Ipecacuanha* (Brotero) A. Richard, known in commerce as Rio Ipecac, or of *Cephaelis acuminata* Karsten, known in commerce as Cartagena Ipecac (Fam. *Rubiaceœ*), without the presence or admixture of more than 5 per cent. of stems or other foreign matter and yielding not less than 1.75 per cent. of the ether-soluble alkaloids of Ipecac.

Official Description.—Rio Ipecac.—In cylindrical pieces, curved and sharply flexuous, occasionally branched, from 3 to 15 cm. in length and from 2.4 to 4 mm. in thickness; externally dark brown, closely annulated, with thickened, incomplete rings, and usually exhibiting transverse fissures with vertical sides; fracture of bark short, of wood tough, bark very thick, light brown, easily separable from the yellowish-white wood.

Stems cylindrical, attaining a length of 10 cm. and a thickness of 2 mm., dark brown, finely longitudinally wrinkled and with a few elliptical scars.

Cartagena Ipecac.—Cylindrical or slenderly fusiform, more or less tortuous, from 3 to 12 cm. in length and from 4 to 6.5 mm. in thickness; externally grayish-brown, the annulations usually not so numerous as in Rio Ipecac, occasionally transversely fissured and with circular scars of roots; bark 2 mm. in thickness, dark brown, smooth, somewhat horny, and easily separable from the light brown wood.

Stems attaining a length of 10 cm. and a thickness of from 2 to 3 mm., cylindrical, somewhat zigzag, due to the prominent nodes with their elliptical stem scars, grayish or dark brown and longitudinally wrinkled; bark thin.

Odor and Taste.—Odor very slight, distinctive, the dust sternutatory; taste bitter and nauseous, somewhat acrid.

Tests for Identity and Purity.—The powder from both varieties of Ipecac is light brown; starch grains numerous, single or from 2- to 4- or more compound, the individual grains, spherical or polygonal, from 0.003 to 0.017 mm. in diameter; calcium oxalate in rhaphides from 0.015 to 0.04 mm. in length, few; tracheids with bordered pores and oblique, slit-like pores. The stem bark shows a few, slightly elongated stone cells, from 0.03 to 0.045 mm. in length, with thick, lignified walls and simple branching pores.

Ipecac yields not less than 1.8 per cent. nor more than 4.5 per cent. of ash.

Assay.—Introduce 10 Gm. of Ipecac, in No. 80 powder, into a 250-mil flask, add 100 mils of ether and proceed as directed under *Belladonnæ Radix*, page 1348, second line of the Assay, beginning with the word "Stopper." Modify the process there given by using 50 mils of the ether solution, representing 5 Gm. of Ipecac, to complete the assay. Use ether instead of chloroform for the final shaking out of the alkaloid, and dissolve the alkaloid from the residue in 10 mils of tenth-normal sulphuric acid V.S.

Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 24 milligrammes of the ether-soluble alkaloids of Ipecac.

U. S. P. Preparations.—Fluidextractum Ipecacuanhæ; Pulvis Ipecacuanhæ et Opii; Syrupus Ipecacuanhæ (from Fluidextract).

N. F. Preparations.—Mistura Rhei Composita (from Fluidextract); Pilulæ ad Prandium (Chapman's); Pilulæ Antidyspepticæ; Pilulæ Laxativæ Compositæ; Pilulæ Laxativæ Post Partum; Syrupus Asari Compositus (from Fluidextract); Syrupus Cimicifugæ Compositus (from Fluidextract); Syrupus Ipecacuanhæ et Opii (from Tincture); Tinctura Ipecacuanhæ et Opii (from Fluidextract); Vinum Ipecacuanhæ (from Fluidextract).

Ipecac contains *emetine* (methyl-cephaeline), $C_{15}H_{22}O_2N$, *cephaeline,* $C_{14}H_{19}O_2N$, and *psychotrine,* also *ipecacuanhic acid,* pectin, starch, resin, sugar, etc. The apothegmatic matter, which is dissolved by hydroalcoholic liquids when percolating it, is slowly precipitated when added to water or syrup. It may be separated by allowing the aqueous liquid to stand until the separation is completed, and then filtering.

Uses.—Ipecac is an emetic, in doses of fifteen grains (1 Gm.), and expectorant, in doses of one grain (0.065 Gm.).

EMETINÆ HYDROCHLORIDUM. U. S. Emetine Hydrochloride [Emet. Hydrochl.]

The hydrochloride [$C_{30}H_{44}O_4N_2.2HCl = 569.31$] of the alkaloid emetine, obtained from ipecac. It contains variable amounts of water of crystallization. Preserve it in dark amber-colored vials, protected from light.

Preparation.—It may be prepared by adding just sufficient diluted hydrochloric acid to emetine, concentrating the solution, and setting it aside to crystallize.

Official Description.—It occurs as a white or very slightly yellowish, crystalline powder. On exposure to light it gradually darkens.

Odor and Reaction.—Without odor. Its aqueous solution (1 in 20) is slightly acid to litmus.

Solubility.—Emetine Hydrochloride is freely soluble in water or alcohol.

Tests for Identity.—Separate portions of an aqueous solution of the salt (1 in 100) yield precipitates with iodine T.S., mercuric potassium iodide T.S., and with platinic chloride T.S.

Sulphuric acid, containing in each mil about 0.005 Gm. of molybdic acid, when added to Emetine Hydrochloride produces a bright green color.

Silver nitrate T.S. produces in an aqueous solution of the salt (1 in 20) a white precipitate insoluble in nitric acid.

Dried to constant weight at 100° C. (212° F.) it loses not more than 19 per cent. of its weight.

No weighable ash remains on incinerating 0.2 Gm. of Emetine Hydrochloride.

Impurities and Tests for Impurities.—*Readily Carbonizable Impurities.*—One-tenth of 1 Gm. of the salt dissolves in 2 mils of sulphuric acid without producing more than a faintly yellow color.

Cephaeline.—Dissolve 0.1 Gm. of Emetine Hydrochloride in 5 mils of distilled water in a separatory funnel, add to the solution 3 mils of sodium hydroxide T.S. and shake it out with 10-mil portions of ether until the residue obtained by evaporating 1 mil of the ethereal liquid, when dissolved in 1 drop of diluted hydrochloric acid and 1 mil of distilled water, no longer yields a turbidity with iodine T.S. Now acidulate the aqueous liquid with diluted sulphuric acid, then add ammonia water until alkaline and shake it with 10 mils of ether. Evaporate this ethereal liquid and add to the residue 1 mil of sulphuric acid containing about 0.005 Gm. of molybdic acid; no purple color is produced.

Uses.—It is used as a specific agent against the various forms of amœbæ that cause dysentery and pyorrhœa alveolaris. It is usually administered hypodermically. Dose, one-third to one grain (0.02–0.065 Gm.).

COCAINA. U. S. Cocaine
[Cocain.]

An alkaloid [$C_{17}H_{21}O_4N$ or $C_8H_{13}(C_6H_5CO)ON.COOCH_3 = 303.18$] obtained from *Erythroxylon Coca* Lamarck and its varieties (Fam. *Erythroxylaceæ*). Preserve it in well-closed containers, protected from light.

Preparation.—It may be made by moistening ground coca leaves with solution of sodium hydroxide, percolating with petroleum benzin, shaking the liquid with diluted sulphuric acid, and adding to the acid solution an excess of solution of sodium hydroxide. The precipitated cocaine is purified by recrystallization. Cocaine can be made synthetically by treating benzoyl-ecgonine with hydrochloric or sulphuric acids in the presence of methyl alcohol.

Official Description.—It occurs in large, colorless, four-sided, or six-sided monoclinic prisms, or as a white, crystalline powder.

Odor.—Odorless.

Solubility.—One Gm. of Cocaine dissolves in about 600 mils of water, 6.5 mils of alcohol, 0.7 mil of chloroform, 3.5 mils of ether and in 12 mils of olive oil at 25° C. (77° F.); also in 270 mils of water at 80° C. (176° F.); very soluble in warm alcohol; slightly soluble in liquid petrolatum.

Test for Identity.—It melts between 96° and 98° C. (204.8°–208.4° F.).

Impurities and Test for Impurities.—On neutralizing carefully an alcoholic solution of Cocaine with diluted hydrochloric acid and evaporating the solution to dryness, the residue responds to the tests for identity and purity under *Cocainæ Hydrochloridum.*

N. F. Preparation.—Oleatum Cocainæ.

Uses.—The alkaloid is used when a solution of cocaine in oil, liquid petrolatum, or fatty substances is needed, or in making the N. F. oleate, otherwise cocaine hydrochloride is preferred. It is a cerebral stimulant and local anæsthetic. Dose, one-fourth to one grain (0.015 to 0.065 Gm.).

COCAINÆ HYDROCHLORIDUM. U. S. Cocaine Hydrochloride

[Cocain. Hydrochl.—COCAINE CHLORIDE COCAINUM HYDROCHLORICUM **P. I.]**

The hydrochloride [$C_{17}H_{21}O_4N.HCl = 339.65$] of the alkaloid cocaine.

Preparation.—It may be made by adding cocaine to an alcoholic solution of hydrochloric acid and crystallizing.

Official Description.—It occurs in colorless, transparent, monoclinic prisms; in flaky, lustrous leaflets or as a white, crystalline powder; permanent in the air.

Odor and Reaction.—Odorless. An aqueous solution of the salt (1 in 20) is neutral to litmus and is lævorotatory.

Solubility.—One Gm. of Cocaine Hydrochloride dissolves in 0.4 mil of water, 3.2 mils of alcohol, and in 12.5 mils of chloroform at 25° C. (77° F.); also in 2 mils of alcohol at 60° C. (140° F.); soluble in glycerin, insoluble in ether.

Tests for Identity.—It melts between 183° and 191° C. (361.4°–375.8° F.), the higher melting point indicating greater purity.

Silver nitrate T.S. produces in an aqueous solution of the salt (1 in 100) a white precipitate insoluble in nitric acid.

Add 5 drops of a solution of chromium trioxide (1 in 20) to 5 mils of a solution of Cocaine Hydrochloride (1 in 50); a yellow precipitate is produced which redissolves on shaking the mixture; on now adding 1 mil of hydrochloric acid, a permanent, orange-colored, crystalline precipitate is formed.

A solution of about 0.01 Gm. of Cocaine Hydrochloride in 1 mil of distilled water yields, on the addition of 2 mils of tenth-normal potassium permanganate V.S., a violet, crystalline precipitate which appears brownish-violet when collected on a filter and shows characteristic, crystalline aggregates under a low-power microscope.

Incinerate 0.5 Gm. of Cocaine Hydrochloride; no weighable ash remains.

Impurities and Tests for Impurities.—*Readily Carbonizable Impurities.*—Dissolve about 0.1 Gm. of the salt in 1 mil of sulphuric acid; not more than a slight yellow tint is produced. Keep this solution at a temperature of 100° C. (212° F.) for five minutes, then cautiously mix it with 2 mils of distilled water; the aromatic odor of methyl benzoate is noticeable and, on cooling, crystals of benzoic acid form, which dissolve on the careful addition of alcohol.

Cinnamyl-Cocaine.—Mix 5 mils of an aqueous solution of the salt (1 in 50) with 0.3 mil of normal sulphuric acid V.S. and 0.1 mil of tenth-normal potassium permanganate V.S.; a violet tint is produced which does not disappear entirely within half an hour.

Isatropyl-Cocaine.—Dilute 5 mils of an aqueous solution of the salt (1 in 50), in a beaker, with distilled water to make 85 mils, add 0.2 mil of ammonia water and stir the solution vigorously during five minutes, with occasional rubbing of the sides of the beaker with a stirring rod. A crystalline precipitate of cocaine is formed and the supernatant liquid is clear. The presence of 0.5 per cent. of isatropyl-cocaine will prevent the formation of nearly all of the precipitate, and will cause the supernatant liquid to be milky.

Uses.—Cocaine hydrochloride is used as a local anæsthetic when applied to the mucous membrane or injected hypodermically; it is also a cerebral stimulant. The dose is from one-fourth to one grain (0.015 to 0.065 Gm.). Because of the habit-forming character of this drug the sale of cocaine or cocaine hydrochloride is forbidden by the Harrison Act and most State laws, except upon physicians' prescriptions, and these must not be renewed, nor may they be filled for habitués.

BETAEUCAINÆ HYDROCHLORIDUM. U. S. Betaeucaine Hydrochloride

[Betaeucain. Hydrochl.—EUCAINE CHLORIDE EUCAINE]

A synthetic derivative of piperidine, containing, when dried to constant weight at 100° C. (212° F.), not less than 99 per cent. of the hydrochloride of 2, 6, 6-trimethyl-4 benzoyloxy-piperidine [$C_{15}H_{21}O_2NHCl$ or $C_5H_7N(CH_3)_3O(C_6H_5CO)HCl = 283.65$].

Preparation.—It is prepared by treating diactonamine with paraldehyde, reducing the product with metallic sodium to vinyl-di-acetone-alkamine and then treating this with benzoyl chloride to produce betaeucaine. This is afterwards neutralized with hydrochloric acid to produce the official salt. While this salt is similar to cocaine in its action as a local anæsthetic, it is not related chemically and it is claimed that it is not habit-forming, and, according to a ruling, is not subject to the restrictions of the Harrison Act.

Official Description.—It occurs as a white, crystalline powder. It is permanent in the air.

Odor and Reaction.—Odorless. Its saturated aqueous solution is neutral to litmus.

Solubility.—One Gm. of Betaeucaine Hydrochloride is soluble in 30 mils of water, 35 mils of alcohol and 6 mils of chloroform at 25° C. (77° F.); it is more soluble in boiling water and boiling alcohol.

Tests for Identity.—Silver nitrate T.S. produces in an aqueous solution of the salt (1 in 100) a white precipitate, insoluble in nitric acid.

About 0.1 Gm. of Betaeucaine Hydrochloride dissolved in 20 mils of distilled water yields with one drop of ammonia water a white precipitate, which dissolves on agitation. On now adding three more drops of ammonia water to this solution, a white precipitate is again produced, which is dissolved on the addition of an equal volume of distilled water. The further addition of ammonia water again produces a precipitate, which dissolves on adding 10 mils of distilled water, but this solution is not affected by the further addition of ammonia water.

Separate portions of 10 mils each of a saturated aqueous solution of the salt yield a white, curdy precipitate on the addition of a few drops of mercuric chloride T.S., and a yellow, curdy precipitate on the addition of a few drops of a mixture of equal volumes of potassium chromate T.S. and diluted sulphuric acid.

Impurities and Tests for Impurities.—*Readily Carbonizable Impurities.*—No color is produced when 0.1 Gm. of Betaeucaine Hydrochloride is dissolved in 1 mil of sulphuric acid.

Cocaine and Alphaeucaine.—Five mils of an aqueous solution of the salt (1 in 100) gives no permanent precipitate on the addition of 5 mils of mercuric chloride T.S.

No weighable ash remains on incinerating 0.5 Gm. of Betaeucaine Hydrochloride.

Assay.—Dissolve about 0.5 Gm. of Betaeucaine Hydrochloride, previously dried to constant weight at 100° C. (212° F.) and accurately weighed, in 100 mils of alcohol, which must be previously neutralized with tenth-normal potassium hydroxide V.S., using phenolphthalein T.S. as indicator, and titrate this alcoholic solution with tenth-normal potassium hydroxide V.S. until the pink color is restored. It shows, in the dried salt, not less than 99 per cent. of $C_{15}H_{21}O_2NHCl$.

Each mil of tenth-normal potassium hydroxide V.S. used corresponds to 0.028365 Gm. of $C_{15}H_{21}O_2NHCl$. Each gramme of Betaeucaine Hydrochloride, previously dried, corresponds to not less than 34.9 mils of tenth-normal potassium hydroxide V.S.

Uses.—It is a local anæsthetic like cocaine, but weaker. It is used in ophthalmology in 2 to 3 per cent. solutions, in 5 to 10 per cent. solutions for the nose and throat, or in a 5 to 10 per cent. ointment in hemorrhoids.

GUARANA. U. S. Guarana

A dried paste consisting chiefly of the crushed seeds of *Paullinia Cupana* Kunth (Fam. *Sapindaceæ*), yielding not less than 4 per cent. of caffeine.

Official Description.—Usually in cylindrical sticks, about 3 to 5 cm. in diameter, externally dark reddish-brown; hard and heavy; fracture uneven, often fissured in the center; internally pale reddish-brown, showing more or less coarse fragments of seeds and occasionally their blackish-brown integuments.

Odor and Taste.—Odor slight; taste slightly astringent and bitter.

Tests for Identity and Purity.—The powder is light pinkish-brown; consisting mostly of irregular masses of parenchyma containing more or less altered starch grains; unaltered starch grains occasional, varying from spherical and polygonal to ellipsoidal and broadly ovoid, 0.01 to 0.025 mm. in diameter; occasional fragments with narrow, elongated sclerenchymatous cells; the walls being thick, yellowish and non-lignified.

Place on a slide a drop of hydrochloric acid, add about 0.001 Gm. of powdered Guarana, then add a drop of gold chloride T.S. and allow the mixture to stand for a few minutes; beginning at the edge of the mount, crystals of caffeine and gold chloride separate in the form of orthorhombic plates and needles, the latter usually occurring in spheroidal aggregates and finally forming branching groups.

Assay.—Introduce 6 Gm. of Guarana, in No. 60 powder, into a flask and add 120 mils of chloroform and 6 mils of ammonia water. Stopper the flask, shake it frequently for half an hour, then let it stand four hours. Again shake the flask vigorously and when the drug has settled, filter the liquid rapidly through a pledget of purified cotton and collect 100 mils of the filtrate, representing 5 Gm. of Guarana. Evaporate the clear filtrate to dryness and dissolve the residue in weak sulphuric acid with the aid of a gentle heat. When the liquid has cooled, filter it into a separator and wash the container and filter with several small portions of distilled water. Now add ammonia water until the liquid is distinctly alkaline to litmus and shake out the caffeine with chloroform until completely extracted, as shown by testing with iodine T.S. in place of the usual mercuric potassium iodide T.S. Evaporate the united chloroform solutions and dry the residue to constant weight at 80° C. (176° F.). The weight is the amount of caffeine from 5 Gm. of Guarana (see Proximate Assays, Chapter LXII).

U. S. P. Preparation.—Fluidextractum Guaranæ.
N. F. Preparation.—Elixir Guaranæ (from Fluidextract).

Guarana contains *caffeine*, $C_8H_{10}N_4O_2$, and about 25 per cent. of tannin, with resin, mucilage, starch, volatile oil, saponin, etc.

Uses.—It is used as a nerve stimulant, in doses of thirty to sixty grains (2 to 4 Gm.). It is effective only in comparatively large doses.

CAFFEINA. U. S. Caffeine

[**Caffein.**—THEINE]

A feebly basic substance [$C_8H_{10}O_2N_4 + H_2O$ or $C_5H(CH_3)_3O_2N_4 + H_2O = 212.14$] obtained from the leaves of *Thea sinensis* Linné (Fam. *Ternstrœmiaceæ*), or from the seeds of *Coffea arabica* Linné (Fam. *Rubiaceæ*); also occurring in some other plants; or prepared synthetically.

Preparation.—Caffeine may be prepared from tea or coffee by precipitating a decoction with lead acetate, removing the excess of lead from the filtrate by hydrogen sulphide, adding ammonia water, evaporating, and recrystallizing. The source of the commercial supply is largely tea dust or sweepings. It may also be made synthetically by the further methylation of theobromine or theophylline which are chemically dimethylxanthine.

Official Description.—It occurs in white, flexible, silky, glistening needles, usually matted together in fleecy masses; efflorescent in dry air.

Odor, Taste, and Reaction.—Odorless and having a bitter taste. A saturated aqueous solution of Caffeine is neutral to litmus.

Solubility.—One Gm. of Caffeine dissolves in 46 mils of water, 66 mils of alcohol, 5.5 mils of chloroform and in 530 mils of ether at 25° C. (77° F.); also in 5.5 mils of water at 80° C. (176° F.) and in 22 mils of alcohol at 60° C. (140° F.).

Tests for Identity.—Caffeine, rendered anhydrous, melts between 235° and 237° C. (455° and 458.6° F.).

Dissolve about 0.01 Gm. of Caffeine in 1 mil of hydrochloric acid in a porcelain dish, add 0.1 Gm. of potassium chlorate and evaporate the solution to dryness on a water bath. Invert the dish over a vessel containing a few drops of ammonia water; the residue acquires a purple color, which is destroyed by fixed alkalies.

An aqueous solution of Caffeine yields a precipitate with tannic acid T.S., soluble in an excess of the reagent.

Caffeine loses not more than 9 per cent. of its weight when dried to constant weight at 80° C. (176° F.).

Incinerate about 2 Gm. of Caffeine; not more than 0.05 per cent. of ash remains.

Impurities and Tests for Impurities.—*Organic Impurities.*—About 0.5 Gm. of Caffeine dissolves in 5 mils of sulphuric or nitric acid without producing more than a faint, yellowish color.

Alkaloids.—Its aqueous solution is not precipitated by mercuric potassium iodide T.S.

U. S. P. Preparation.—Caffeina Citrata.

N. F. Preparations.—Caffeinæ Sodio-Salicylas; Pulvis Acetanilidi Compositus; Sal Potassii Bromidi Effervescens Compositus.

Uses.—Caffeine is a nerve stimulant. It is chiefly used in nervous headaches of a certain type. The dose is from one to three grains (0.065 to 0.2 Gm.).

CAFFEINA CITRATA. U. S. Citrated Caffeine

[Caffein. Cit.]

Citrated Caffeine contains, when dried to constant weight at 80° C. (176° F.), not less than 48 per cent. of anhydrous caffeine [$C_8H_{10}O_2N_4 = 194.12$].

	Metric	Old form
***Caffeine**	**50 Gm.**	**1 oz. av.**
Citric Acid	**50 Gm.**	**1 oz. av.**
Distilled Water, hot	**100 mils**	**2 fl. oz.**

Dissolve the citric acid in the hot distilled water, add the caffeine, and evaporate the resulting solution to dryness on a water bath, constantly stirring toward the end of the operation. Reduce the product to a fine powder and transfer it to well-closed containers.

This is not a definite chemical salt, but a mixture of caffeine and citric acid, caffeine being a feeble alkaloid. Hence the common name *citrate of caffeine* is improper.

Official Description.—It occurs as a white powder.

Odor, Taste, and Reaction.—Odorless and having a slightly bitter, acid taste. Its aqueous solution (1 in 30) is acid to litmus.

Solubility.—It gives a clear, syrupy solution with a small quantity of water, but caffeine precipitates on dilution. This precipitate redissolves on the further addition of water.

Tests for Identity.—Dissolve about 0.02 Gm. of Citrated Caffeine in 1 mil of hydrochloric acid in a porcelain dish, add 0.1 Gm. of potassium chlorate, evaporate the mixture on a water bath and invert the dish over a vessel containing a few drops of ammonia water; the residue acquires a purple color, which is destroyed by alkalies.

About 2 mils of a filtered aqueous solution of Citrated Caffeine (1 in 10) mixed with 50 mils of lime water remains clear in the cold, but becomes turbid when heated to boiling.

When dried to constant weight at 80° C. (176° F.) it loses not more than 5 per cent. of its weight.

Incinerate about 1 Gm. of Citrated Caffeine; not more than 0.1 per cent. of ash remains.

Impurities and Tests for Impurities.—*Tartaric Acid.*—Heat a mixture of 0.25 Gm. of Citrated Caffeine and 5 mils of sulphuric acid in a porcelain dish on a water bath for fifteen minutes, protecting it from dust; it may become yellow in color but not brown or black.

Heavy Metals.—An aqueous solution of Citrated Caffeine does not respond to the Test for heavy metals (U. S. P., Test No. 3, Chapter LXII).

Sulphuric Acid.—The addition of a few drops of barium chloride T.S. to 10 mils of an aqueous solution of Citrated Caffeine (1 in 100), previously treated with a few drops of hydrochloric acid, produces no turbidity.

Assay.—Dissolve about 0.5 Gm. of Citrated Caffeine, previously dried to constant weight at 80° C. (176° F.) and accurately weighed, in 10 mils of hot distilled water, add an excess of sodium hydroxide T.S., cool the solution, and shake it in a separator with three successive portions of 20 mils, 10 mils, and 5 mils, respectively, of chloroform, or more if necessary to complete the extraction. Evaporate the combined chloroform solutions on a water bath and dry the residue to constant weight at 80° C. (176° F.). The weight of anhydrous caffeine ($C_8H_{10}O_2N_4$) so obtained corresponds to not less than 48 per cent. of the weight of Citrated Caffeine taken. This residue, when recrystallized from hot water, and dried to constant weight at 80° C. (176° F.), has the melting point given under *Caffeina*.

U. S. P. Preparation.—Caffeina Citrata Effervescens.

Uses.—It is used as a cerebral stimulant in doses of three to eight grains (0.2 to 0.5 Gm.), and in making the effervescent salt (see below).

CAFFEINA CITRATA EFFERVESCENS. U. S. Effervescent Citrated Caffeine

[Caff. Cit. Eff.]

It contains not less than 1.9 per cent. of anhydrous caffeine [$C_8H_{10}O_2N_4 = 194.12$].

	Metric	Old form
***Citrated Caffeine**	40 Gm.	350 gr.
Sodium Bicarbonate, dried and powdered	570 Gm.	11 oz. av. 175 gr.
Tartaric Acid, dried and powdered	300 Gm.	6 oz. av.
Citric Acid, uneffloresced crystals	195 Gm.	3 oz. av. 394 gr.
To make about	1000 Gm.	20 oz. av.

Powder the citric acid and mix it intimately with the citrated caffeine and tartaric acid, then thoroughly incorporate the sodium bicarbonate. Place the mixed powders on a plate of glass or in a suitable dish, in an oven heated to between 93° and 104° C. (199.4°-219.2° F.). Manipulate the mixture carefully with a wooden spatula, and, when it has become moist, rub it through a No. 6 tinned-iron sieve, and dry the granules at a temperature not exceeding 54° C. (129.2° F.). Immediately transfer the product to suitable containers and seal them tightly. Care must be used to prevent the preparation from coming in contact with air containing moisture.

Assay.—Dissolve about 5 Gm. of Effervescent Citrated Caffeine, accurately weighed in 10 mils of hot distilled water. When effervescence has ceased, add an excess of sodium hydroxide T.S., cool the mixture and shake it in a separator with three successive portions of 20 mils, 10 mils, and 5 mils, respectively, of chloroform, or more if necessary to complete the extraction. Evaporate the combined chloroform solutions on a water bath and dry the residue to constant weight at 80° C. (176° F.). The weight of anhydrous caffeine ($C_8H_{10}O_2N_4$) so obtained corresponds to not less than 1.9 per cent. of the weight of Effervescent Citrated Caffeine taken. This residue, when recrystallized from hot water, responds to the tests for identity, and, when dried to constant weight at 80° C. (176° F.), has the melting point given under *Caffeina.*

Uses.—This effervescent salt is used for preparing a pleasant stimulating draught by adding a teaspoonful (4 Gm.) to four fluidounces of water.

CAFFEINÆ SODIO-BENZOAS. U. S. Caffeine Sodio-Benzoate

[Caff. Sod. Benz.]

A mixture of caffeine and sodium benzoate. It contains, when dried to constant weight at 80° C. (176° F.), not less than 46 per cent. nor more than 50 per cent. of anhydrous caffeine [$C_8H_{10}O_2N_4 = 194.12$], the remainder being sodium benzoate [$NaC_7H_5O_2 = 144.04$]. Preserve it in well-closed containers.

Preparation.—It may be prepared by triturating together equal parts of caffeine and sodium benzoate, in a mortar, with enough alcohol to form a smooth paste, drying at a moderate heat and powdering.

Official Description.—It occurs as a white powder.

Odor, Taste, and Reaction.—It is odorless and has a slightly bitter taste. An aqueous solution (1 in 20) may be neutral, slightly acid, or slightly alkaline to litmus, but is not reddened by phenolphthalein T.S.

Solubility.—One Gm. of Caffeine Sodio-Benzoate dissolves in 1.1 mils of water, some caffeine separating on standing, and in 30 mils of alcohol, at 25° C. (77° F.); partly soluble in chloroform.

Tests for Identity.—On heating the compound, it is decomposed with the evolution of white vapors, leaving a carbonaceous residue which effervesces with acids and colors a non-luminous flame intensely yellow.

Ferric chloride T.S. produces a salmon-colored precipitate in an aqueous solution of the compound. The addition of diluted hydrochloric acid produces a white precipitate of benzoic acid.

Impurities and Tests for Impurities.—*Readily Carbonizable Organic Matter.*—About 0.1 Gm. of Caffeine Sodio-Benzoate dissolves in 2 mils of sulphuric acid without producing more than a slight, yellow color.

Heavy Metals.—An aqueous solution (1 in 50), acidulated with hydrochloric acid and filtered, does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

When dried to constant weight at 80° C. (176° F.), it loses not more than 5 per cent. of its weight.

Assay for Caffeine.—Dissolve about 1 Gm. of Caffeine Sodio-Benzoate, previously dried to constant weight at 80° C. (176° F.) and accurately weighed, in 5 mils of distilled water in a separator, add 5 mils of sodium hydroxide T.S. and shake the mixture with four successive portions of 20 mils, 10 mils, 10 mils, and 5 mils, respectively, of chloroform. Evaporate the combined chloroform solutions on a water bath and dry the residue to constant weight at 80° C. (176° F.). The weight of anhydrous caffeine ($C_8H_{10}O_2N_4$) so obtained corresponds to not less than 46 per cent. nor more than 50 per cent. of the weight of dried Caffeine Sodio-Benzoate taken.

This residue, when recrystallized from hot water, responds to the tests of identity and, when dried to constant weight at 80° C. (176° F.), has the melting point given under *Caffeina.*

Assay for Sodium Benzoate.—When dried to constant weight at 80° C. (176° F.) and estimated as directed under the Assay for alkali salts of organic acids (see U. S. P., Test No. 6, Chapter LXII) it shows, in the dried mixture, not less than 50 per cent. nor more than 54 per cent. of sodium benzoate ($NaC_7H_5O_2$).

Uses.—Its solubility renders it especially adaptable for the hypodermic injection of caffeine. It is a diuretic and cardiac stimulant. Dose, by the mouth, five grains (0.32 Gm.); hypodermically, three grains (0.2 Gm.).

CAFFEINÆ SODIO-SALICYLAS. N. F. Caffeine Sodio-Salicylate

[Caff. Sod.-Sal.]

	Metric	Old form
Caffeine	50 Gm.	2 oz. av.
Sodium Salicylate	50 Gm.	2 oz. av.
Alcohol,		
To make about	100 Gm.	4 oz. av.

Triturate the caffeine with the sodium salicylate and a sufficient quantity of alcohol to produce a smooth paste and dry this by exposure to air in a moderately warm place. Reduce the dry mass to powder and keep it in well-stoppered bottles.

Uses.—It is used as a diuretic, anti-rheumatic, and stimulant. It is used hypodermically. Dose, three to five grains (0.2–0.32 Gm.).

THEOPHYLLINA. U. S. Theophylline

[Theophyll.—DIMETHYLXANTHINE]

An organic base [$C_7H_8O_2N_4 + H_2O$ or $1:3\ C_5H_2(CH_3)_2.O_2N_4 + H_2O = 198.12$], isomeric with theobromine. It is found in small amounts in the leaves of *Thea sinensis* Linné (Fam. *Ternstrœmiaceæ*) and is also prepared synthetically.

Preparation.—It is a natural alkaloid in tea in small amounts, but it is being made synthetically by a complicated process involving the methylation of uric acid. This is the first alkaloid to be made artificially on a commercial scale.

Official Description.—It occurs as a white, crystalline powder. It is permanent in the air.

Odor, Taste, and Reaction.—Odorless and having a bitter taste. A saturated aqueous solution of Theophylline is neutral to litmus.

Solubility.—One Gm. of Theophylline dissolves in 100 mils of water and 80 mils of alcohol at 25° C. (77° F.). It is more readily soluble in hot water; sparingly soluble in ether. It is readily soluble in solutions of the alkali hydroxides and in ammonia water.

Tests for Identity.—It melts between 269° and 272° C. (516.2° and 521.6° F.).

Dissolve about 0.01 Gm. of Theophylline in 1 mil of hydrochloric acid in a porcelain dish, add 0.1 Gm. of potassium chlorate, evaporate the solution to dryness on a water bath and invert the dish over a vessel containing a few drops of ammonia water; the residue acquires a purple color which is destroyed by fixed alkalies.

An aqueous solution of Theophylline yields a precipitate with tannic acid T.S. which is soluble in an excess of the reagent.

Impurities and Tests for Impurities.—*Caffeine or Theobromine.*—Dissolve about 0.5 Gm. of Theophylline in 5 mils of potassium hydroxide T.S. and add 15 mils of a solution containing 0.5 Gm. of sulphanilic acid and 5 mils of hydrochloric acid in 100 mils of distilled water and then add 5 mils of an aqueous solution of sodium nitrite (1 in 200). When this mixture is brought nearly to boiling and sodium hydroxide T.S. is added, drop by drop, a blood red color is produced.

Caffeine, Theobromine, or Paraxanthine.—A clear solution is produced when about 0.2 Gm. of Theophylline is dissolved in 5 mils of sodium hydroxide T.S. or in 5 mils of ammonia water.

Theophylline loses not more than 9.5 per cent. of its weight when dried to constant weight at 100° C. (212° F.).

Incinerate about 0.1 Gm. of Theophylline; no weighable ash remains.

Organic Impurities.—About 0.2 Gm. of Theophylline dissolves in 5 mils of sulphuric acid, without producing more than a faint yellow color.

Uses.—It is used as a stimulating diuretic, similar to caffeine. Dose, four grains (0.25 Gm.).

THEOBROMINÆ SODIO-SALICYLAS. U. S. Theobromine Sodio-Salicylate

[Theobrom. Sodio-Sal.]

Sodium theobromine [$C_7H_7O_2N_4Na = 202.10$] and sodium salicylate [$NaC_7H_5O_3 = 160.04$] in approximately molecular proportions. It yields, when dried to constant weight in a desiccator over sulphuric acid, not less than 46.5 per cent. of theobromine [$C_7H_8O_2N_4 = 180.10$]. Preserve it in well-closed containers.

Preparation.—*Theobromine,* which is obtained from the seed of *Theobroma Cacao,* is said to be absent in the unfermented seeds, but is developed in the curing process, through the splitting up of a glucoside. It may be prepared by boiling the powdered beans with water, filtering, precipitating the tannins and coloring matter with lead acetate, removing the lead with sulphuric acid, filtering, concentrating, adding magnesia, evaporating to dryness, extracting the residue with alcohol, and purifying the product by recrystallization.

The official salt, commonly known as *diuretin,* is made by preparing an alcoholic solution of sodium hydroxide, adding an amount equal to 20 parts of the hydroxide to 100 parts of water and 90 parts of theobromine, and warming the mixture until solution results. This is then added to 80 parts of sodium salicylate in 75 parts of water and the solution quickly evaporated to dryness and powdered.

Official Description.—It is a white powder. It gradually absorbs carbon dioxide from the air with the liberation of theobromine, becoming partially insoluble in water.

Odor, Taste, and Reaction.—Odorless, of a sweetish, saline and somewhat alkaline taste. An aqueous solution of Theobromine Sodio-Salicylate (1 in 20) is colorless and clear or at most opalescent, and is strongly alkaline to litmus and phenolphthalein T.S.

Solubility.—One Gm. of Theobromine Sodio-Salicylate dissolves in 1 mil of water at 25° C. (77° F.); slightly soluble in alcohol.

Tests for Identity.—When ignited Theobromine Sodio-Salicylate yields a residue which colors a non-luminous flame intensely yellow and effervesces with acids.

An aqueous solution of Theobromine Sodio-Salicylate (1 in 100), slightly acidulated with acetic acid, becomes violet on the addition of ferric chloride T.S.

Impurities and Tests for Impurities.—*Caffeine.*—Dissolve 1 Gm. of Theobromine Sodio-Salicylate in 10 mils of distilled water in a separator, add a few mils of sodium hydroxide T.S. and shake the mixture with 10 mils of chloroform. The residue obtained after the evaporation of the separated chloroform layer, when dried to constant weight at 80° C. (176° F.), does not exceed 0.005 Gm.

Sodium Carbonate.—About 0.1 Gm. of Theobromine Sodio-Salicylate dissolves in 2 mils of sulphuric acid without effervescing and

Organic Impurities.—without producing more than a slight color.

Assay.—Dissolve about 2 Gm. of Theobromine Sodio-Salicylate, previously dried to constant weight in a desiccator over sulphuric acid, and accurately weighed, in 10 mils of warm distilled water, and titrate the solution with normal hydrochloric acid V.S., phenolphthalein T.S. being used as indicator. Not more than 5.5 mils of normal hydrochloric acid V.S. is required to neutralize 2 Gm. of Theobromine Sodio-Salicylate. The solution should now be slightly alkaline to litmus or be made so by the addition of one or two drops of very dilute ammonia water. Allow it to stand at from 20° to 25° C. (68°–77° F.) for three hours, stirring occasionally, then transfer the precipitate of theobromine obtained to a dried and weighed filter of 9 cm. in diameter, and wash the precipitate and filter with four successive portions of 5 mils each of ice-cold distilled water, afterwards dry the filter and contents at 100° C. (212° F.) and weigh. To the weight of precipitate thus obtained add for each 2 Gm. of salt, 0.13 Gm. (the approximate quantity of theobromine remaining in the liquid and washings). The sum corresponds to not less than 46.5 per cent. of the weight of dried Theobromine Sodio-Salicylate taken.

About 0.05 Gm. of the precipitate obtained in the preceding assay, when evaporated to dryness on a water bath with 1 mil of hydrochloric acid and about 0.1 Gm. of potassium chlorate, leaves a reddish-yellow residue, which becomes purple on moistening with a drop of ammonia water. Another portion of about 0.2 Gm. of the precipitate, when slowly heated, volatilizes without melting and without leaving a weighable residue.

Uses.—It is used as a diuretic in cardiac dropsy and chronic Bright's disease. The dose is fifteen grains (1 Gm.).

ASPIDOSPERMA. U. S. Aspidosperma

[Aspidosp.—Quebracho]

The dried bark of *Aspidosperma Quebracho blanco* Schlechtendal (Fam. *Apocynaceæ*), without the presence or admixture of more than 2 per cent. of wood or other foreign matter. It contains the alkaloids *aspidospermine*, $C_{22}H_{30}O_2N_2$, *aspidospermatine*, $C_{22}H_{28}O_2N_2$, *aspidosamine*, *quebrachine*, *hydroquebrachine*, and *quebrachamine*. The commercial *aspidospermine* is usually a mixture of the above alkaloids. In addition it contains two sugars, *quebrachit* and *inosit*, and tannin.

Official Description.—In irregular chips or in longitudinal pieces attaining a length of 14 cm. and a thickness of 35 mm.; outer corky layer from 3 to 25 mm. in thickness, brownish-gray or reddish-brown and deeply furrowed, frequently somewhat reticulate with longitudinal and shallow transverse fissures, the crevices being occasionally lined with the mycelia of a grayish mould; outer surface of bark, from which the cork has been separated, light brown or reddish-brown and usually more or less roughened; inner surface occasionally with adhering wood, otherwise light yellowish-brown to light reddish-brown, longitudinally finely striate and finely porous; fracture short-fibrous with projecting bast-fibers.

Odor and Taste.—Nearly inodorous, taste bitter and slightly aromatic.

Tests for Identity and Purity.—Under the microscope, transverse sections of Aspidosperma show a number of successive layers of cork separated by large groups of stone cells, isolated bast-fibers and parenchyma; inner bark with starch-bearing medullary rays 1 to 5 cells in width, separating narrow wedges composed of large prominent groups of stone cells in which are occasionally included one or more thick-walled bast-fibers; bast-fibers usually single, very thick-walled, strongly lignified and surrounded with crystal fibers and starch-bearing parenchyma.

The powder is reddish-brown; bast-fibers single, very long and surrounded by crystal fibers, the crystals being in prisms frequently terminated by pyramids and from 0.008 to 0.03 mm. in length; stone cells in large thick groups composed of numerous more or less tabular cells; cork cells more or less polygonal in outline with thick, slightly lignified walls; starch grains single or 2- to 4-compound, the individual grains spherical, ovoid or more or less plano-convex, from 0.003 to 0.025 mm. in diameter.

U. S. P. Preparation.—Fluidextractum Aspidospermatis.

Uses.—A respiratory sedative, used in dyspnœa (loss of voice), and in asthmatic conditions. Dose, thirty to sixty grains (2 to 4 Gm.). The sulphates of aspidospermine and quebrachine are used hypodermically and by the mouth in doses of one to two grains (0.065 to 0.13 Gm.).

SPIGELIA. U. S. Spigelia

[PINKROOT]

The dried rhizome and roots of *Spigelia marilandica* Linné (Fam. *Loganiaceæ*), without the presence or admixture of more than 10 per cent. of stems or other foreign matter.

Official Description.—Rhizome horizontal or slightly oblique, more or less flexuous, somewhat branched, from 1.5 to 5 cm. in length and from 2 to 5 mm. in diameter; externally dark brown, slightly annulate, with scars of bud scales, the upper surface knotty, from approximate stem-bases, bearing cup-shaped scars; from the lower and lateral portions arise numerous long, rather coarse, sparingly branched, brittle roots; fracture short, internally differentiated into three nearly equal zones of pith, wood and bark.

Few if any of the roots exhibit thin, terminal portions with the bark stripped from the slender strands of wood.

Stems usually attached to the upper portion of the rhizome, nearly cylindrical, attaining a length of 6 cm. and a diameter of 3 mm., light grayish-brown to purplish-brown, nodes annulate, marked by opposite leafscars.

Odor and Taste.—Odor slightly aromatic; taste bitter, pungent.

Tests for Identity and Purity.—Under the microscope, transverse sections of the rhizome of Spigelia show a dark brown, more or less exfoliated epidermal layer; a cortex composed of from 10 to 15 rows of starch-bearing parenchyma; a distinct zone of sieve tissue from 0.075 to 0.15 mm. in width; a compact woody area composed of tracheæ and tracheids which are hardly distinguishable from each other, both kinds of vessels being marked with bordered pores; an internal sieve closely resembling the sieve in the bark; and a pith composed of fairly uniform, nearly polygonal, thin-walled cells, more or less filled with small starch grains.

Transverse sections of the root show a large cortex, the cells of which are more or less filled with small starch grains and a central stele of 6 or 8 radial fibro-vascular bundles, which in the older roots are united by a strong development of lignified cells.

The stem in transverse section is distinguished from the rhizome by a narrower woody zone, the tracheæ having spiral thickenings, and by a nearly uninterrupted circle of non-lignified bast-fibers in the bark.

The powder is grayish-brown; when examined under the microscope it exhibits starch grains generally numerous, at times, however, few, spherical or slightly angular, from 0.002 to 0.006 mm. in diameter; fragments of lignified tracheæ and tracheids conspicuous; fragments of tracheæ with spiral thickening relatively few; bast-fibers few, very long, non-lignified; occasional fragments of the reddish-brown epidermal cells.

Spigelia yields not more than 10 per cent. of ash.

U. S. P. Preparation.—Fluidextractum Spigeliæ.

Spigelia contains a bitter principle, a liquid alkaloid named by Dudley *spigeline,* resin, and a trace of volatile oil, with tannin and wax. Alcohol and water extract its virtues.

Uses.—It is used as an anthelmintic. Dose, one drachm (4 Gm.).

SPARTEINÆ SULPHAS. U. S. **Sparteine Sulphate**

[Spartein. Sulph.]

The sulphate [$C_{15}H_{26}N_2.H_2SO_4 + 5H_2O = 422.39$] of sparteine, a liquid alkaloid obtained from *Cytisus Scoparius* (Linné), Link (Fam. *Leguminosæ*). Preserve it in well-closed containers, protected from light.

The salts of sparteine are mostly crystallizable, although the alkaloid itself is liquid.

Official Description.—It occurs in colorless, rhombohedral crystals, or as a crystalline powder. It is hygroscopic.

Odor, Taste, and Reaction.—Odorless and having a slightly saline and somewhat bitter taste. Its aqueous solution (1 in 20) is neutral or acid to litmus.

Solubility.—One Gm. of Sparteine Sulphate dissolves in 1.1 mils of water and in 3 mils of alcohol at 25° C. (77° F.); insoluble in chloroform or ether.

Tests for Identity.—Add 25 mils of ether and a few drops of diluted ammonia water, avoiding an excess, to about 0.1 Gm. of Sparteine Sulphate in a test tube, then add to the mixture an ethereal solution of iodine (1 in 50) until the liquid, when shaken, turns from an orange to a dark reddish-brown color. After a short time, the bottom and sides of the test tube will be coated with minute, dark greenish-brown crystals.

Barium chloride T.S. produces a white precipitate insoluble in hydrochloric acid when added to an aqueous solution of Sparteine Sulphate.

Incinerate about 1 Gm. of Sparteine Sulphate; not more than 0.1 per cent. of ash remains.

Impurities and Tests for Impurities.—*Readily Carbonizable Organic Impurities.*—A solution of about 0.1 Gm. of the salt in 2 mils of sulphuric acid is colorless.

Ammonium Salts.—Shake about 0.1 Gm. of Sparteine Sulphate in a test tube with 5 mils of potassium hydroxide T.S., the liquid at first becomes turbid, and small, colorless or nearly colorless drops of sparteine gradually collect on the surface. Suspend a strip of moistened red litmus paper in the mouth of the test tube, and apply a gentle heat; the test paper gradually acquires a blue color, but no odor of ammonia is perceptible.

Aniline.—A mixture of about 0.1 Gm. of Sparteine Sulphate, 0.5 mil of chloroform and 0.5 mil of alcoholic half-normal potassium hydroxide V.S. does not emit an odor of phenylisocyanide on heating.

Uses.—Sparteine sulphate is a cardiac stimulant and narcotic. Dose, one-sixth of a grain (0.01 Gm.).

LOBELIA. U. S. **Lobelia**

[Lobel.—Indian Tobacco]

The dried leaves and flowering tops of *Lobelia inflata* Linné (Fam. *Lobeliaceæ*), without the presence or admixture of more than 10 per cent. of stems or other foreign matter.

Official Description.—Stems cylindrical, coarsely and irregularly furrowed, yellowish-green, occasionally purplish and with numerous spreading hairs; leaves alternate, sessile or narrowing into a short petiole, usually more or less broken; when entire, laminæ ovate or oblong, from 2 to 9 cm. in length, obtusely toothed or irregularly serrate-denticulate, each tooth with a yellowish-brown, gland-like apex; pale green and with scattered, bristly hairs; flowers blue in long, loose racemes with short pedicels, calyx tube ovoid, with 5 subulate teeth, corolla tubular, from 3 to 4 mm. in length, 5-parted, the upper 2-lobed portion cleft nearly to the base; stamens with anthers united above into a curved tube enclosing the bifid stigmas; capsules ovoid or ellipsoidal, from 5 to 8 mm. in length, light brown, wholly inferior and enclosing numerous brownish, oblong and coarsely reticulate seeds.

Odor and Taste.—Odor slight, taste strongly acrid.

Tests for Identity and Purity.—The powder is dark green, odor irritating; fragments of seed-coat composed of more or less polygonal cells with thick, yellowish walls; occasionally, non-glandular hairs elongated-conical, from 0.3 to 0.6 mm. in length; fragments of stem with tracheæ showing annular or spiral thickenings or simple pores associated with narrow wood-fibers, the walls of the latter being rather thin, more or less lignified and porous; fragments of epidermis of leaf with elliptical stomata, 0.025 mm. in length and usually with 3 or 4 neighboring cells; pollen grains nearly spherical, from 0 .015 to 0.03 mm. in diameter.

Lobelia yields not more than 8 per cent. of ash.

U. S. P. Preparations.—Fluidextractum Lobeliæ; Tinctura Lobeliæ.

Lobelia contains *lobeline, lobelic acid, lobelacrin, inflatin* and *lobelianin,* a volatile oil, wax, resin, gum, etc. Lobeline, the alkaloid, is usually considered to be a liquid alkaloid, without oxygen, but forming crystalline salts.

Uses.—Lobelia is used as an expectorant and emetic. Dose, two to forty grains (0.13 to 2.6 Gm.).

BAPTISIA. N. F. Baptisia

[**Baptis.**—Wild Indigo]

The dried roots of *Baptisia tinctoria* (Linné) R. Brown (Fam. *Leguminosæ*), without the presence of more than 10 per cent. of the crown and stem or other foreign matter.

It contains *cytisine* or *baptitoxine,* and several glucosides, *baptisin, baptigenin, pseudobaptisin,* and *baptin,* also resin.

Official Description.—Fleshy, from 0.5 to 4 cm. in thickness, usually cut into elongated cylindrical pieces; the crown from 5 to 8 cm. in thickness, more or less warty and marked by stem scars; outer surface dark brown; usually longitudinally wrinkled, transversely warty, or the thicker pieces covered with a soft and friable corky layer bearing few branching rootlets; fracture tough, the fractured surface whitish; bark-section radially striate, wood-section inconspicuously radiate, porous.

Odor and Taste.—Nearly odorless; the bark bitter and acrid, the wood nearly tasteless.

Tests for Identity and Purity.—The powdered drug is light-grayish and, when examined with the microscope, shows numerous rounded, simple, or two- to four-compound starch grains up to 0.016 mm. in diameter, the larger grains sometimes with a cleft through the center; tracheæ with bordered pores up to 0.085 mm. in diameter; numerous sclerenchyma cells, long, thick-walled, non-porous, more or less lignified and up to 0.024 mm. in width; fragments of medullary-ray tissue composed of cells with lignified walls and numerous simple pores; groups of parenchyma, many of the cells filled with starch; few epidermal and cork cells with brownish walls.

Baptisia yields not more than 5 per cent. of ash.

N. F. Preparation.—Fluidextractum Baptisiæ.

Uses.—It is a cathartic and hepatic stimulant, also employed as a nerve stimulant and antipyretic. It is also used in pharmacy to produce a yellow color in such preparations as the antiseptic solutions. Dose, fifteen grains (1 Gm.).

BERBERIS. N. F. Berberis

(U. S. P. VIII)

[**Berber.**—Oregon Grape Root]

The rhizome and roots of species of the section *Odostemon* Rafinesque of the genus *Berberis* Linné (Fam. *Berberidaceæ*), without the presence of more than 5 per cent. of the overground parts of the plant or other foreign matter. Berberis without the bark should be rejected.

Berberis contains a yellow alkaloid, *berberine*, $C_{20}H_{17}O_4N$, and *oxyacanthine* (*berbine* or *vinetine*), $C_{18}H_{19}O_3N$, and *berbamine*, $C_{18}H_{19}O_3N$.

Official Description.—Cylindrical, more or less knotty, strongly branched, usually cut into pieces of varying length and up to 45 mm. in diameter; externally light yellowish-brown, longitudinally wrinkled and short scaly; fracture hard and tough; bark 1 mm. in thickness, easily separable into layers; wood yellow, the color more pronounced upon wetting, distinctly radiate, and showing rings of growth; pith of rhizome small, sometimes excentral.

Odor and Taste.—Slightly odorous; taste distinctive, very bitter; on chewing it tinges the saliva yellow.

Tests for Identity and Purity.—The powder is yellowish-brown; composed chiefly of fragments of wood-fibers associated with a few tracheæ and medullary rays; wood-fibers yellowish, scarcely giving any reaction with phloroglucinol T.S. and hydrochloric acid, and with large, simple, transverse pores; tracheæ chiefly with bordered pores, occasionally reticulate; medullary rays one to twelve cells wide, and in very long rows; starch grains simple or two- to three-compound, the individual grains being irregularly spherical, from 0.003 to 0.01 mm. in diameter, and occasionally larger.

Berberis yields not more than 5 per cent. of ash.

N. F. Preparation.—Fluidextractum Berberidis.

Uses.—It is used as a tonic, hepatic stimulant, antiperiodic, and febrifuge. Dose, thirty grains (2 Gm.).

CACTUS GRANDIFLORUS. N. F. **Cactus Grandiflorus**

[**Cact. Grand.**—Night Blooming Cereus]

The fresh succulent stems of the wild growing *Cactus grandiflorus* Linné (*Cereus grandiflorus* Miller) (Fam. *Cactaceæ*). As found in commerce, Cactus Grandiflorus is usually preserved in alcohol and the amount of alcohol present should be stated on the label.

Its constituents have not been well studied; it contains a small amount of alkaloid, glucosidal bodies, acid, fat, etc. The preserved fresh stems only are recognized by the N. F., never the dried plant.

Official Description.—It occurs in pieces of varying length, from 1.5 to 4 cm. in diameter, and from five- to seven-angled. On the angles at intervals of about 2 cm. are tufts of from nine to twelve spines, each about 2 mm. in length, and three slender flexuous spines about 1 cm. in length; at irregular intervals are branched roots.

Odor and Taste.—It has a strong, herby odor; taste acidulous and mucilaginous.

Test for Identity and Purity.—The transverse section shows a central cylinder about 3 mm. in diameter and a spongy parenchyma containing large crystals and rhaphides of calcium oxalate.

N. F. Preparation.—Tinctura Cacti Grandiflori.

Uses.—It is employed as a substitute for digitalis in cardiac weakness. The dose of the tincture is fifteen minims (1 mil).

COCCULUS INDICUS. N. F. **Cocculus Indicus**

[**Coccul. Ind.**—Fish Berry Indian Berry]

The dried fruit of *Anamirta Cocculus* (Linné) Wight et Arnott (Fam. *Menispermaceæ*).

It contains the alkaloids *menispermine*, $C_{18}H_{24}O_2N_2$, and *paramenispermine* and *hydropicrotoxic acid*, also *picrotoxin* the poisonous principle.

Official Description.—Reniform, about 10 mm. in length and 6 mm. in breadth and thickness, blackish-brown, wrinkled; hilum and micropyle close together, separated by a shallow sinus and connected by an obscure ridge running around the convex side. Seed urn-shaped, its longitudinal and transverse sections crescent-shaped.

Odor and Taste.—Taste slightly bitter; the seed whitish-yellow and intensely bitter.

Test for Identity and Purity.—Cocculus Indicus yields not more than 5 per cent. of ash.

N. F. Preparation.—Tinctura Cocculi Indici.

Uses.—The tincture is used externally as a parasiticide.

COFFEA TOSTA. N. F. Coffee

[**Coff. Tost.**—ROASTED COFFEE]

The dried ripe seeds of *Coffea arabica* Linné or *Coffea liberica* Bulliard (Fam. *Rubiaceæ*), roasted until they develop a dark brown color and a characteristic aroma, and yielding not less than 1 per cent. of caffeine.

Its chief constituent is *caffeine,* although it contains tannic acid and *caffeic* and *quinic acids.*

Official Description.—Oval, of variable size, having one side strongly convex, the other flat with a longitudinal groove, and showing traces of the papery seed-coat in the cleft.

Odor and Taste.—It has a characteristic aroma and a pleasantly bitter taste.

Tests for Identity and Purity.—Percolate 1 Gm. of powdered Coffee with ether until exhausted and evaporate the percolate to dryness; the residue weighs not less than 0.1 Gm. (presence of at least *10 per cent. of fat*).

Powdered Coffee, when examined under the microscope, exhibits numerous fragments of the seed-coat made up of parenchyma and irregular stone cells, the latter from 0.2 to 1 mm. in length and from 0.015 to 0.05 mm. in width, with walls having simple pores; numerous brownish endosperm cells having porous walls about 0.01 mm. in thickness and containing oil and aleurone grains; starch grains few or absent.

Coffee yields not less than 3 per cent. nor more than 5 per cent. of ash.

Impurities and Tests for Impurities.—*Starch.*—Boil 1 Gm. of powdered Coffee with 10 mils of distilled water, filter and acidify the filtrate with 1 mil of diluted sulphuric acid, and then decolorize it by the cautious addition of potassium permanganate T.S. This decolorized solution shows no blue coloration upon the addition of iodine T.S.

Artificial Colors or Facings.—Shake 1 Gm. of Coffee with 20 mils of water; the strained liquid shows no colored or heavy deposit. Shake 1 Gm. of Coffee with 20 mils of alcohol; the strained liquid shows no colored or heavy deposit, nor is any color imparted to the alcohol.

Assay.—To 6 Gm. of Coffee, in No. 60 powder, contained in a small flask, add 50 mils of purified petroleum benzin and agitate the mixture occasionally during one hour. Then allow it to settle and decant the benzin solution. Add 50 mils more of the petroleum benzin, shake the mixture occasionally during fifteen minutes, then filter off the benzin and dry the drug. Now transfer the Coffee residue to a bottle having a capacity of about 250 mils and pour upon it 120 mils of chloroform and 6 mils of ammonia water. Stopper the bottle securely and shake it vigorously at intervals during six hours. Then allow it to stand one hour, and filter off 100 mils of the chloroform solution. Transfer this to a beaker and evaporate the chloroform at a gentle heat. Dissolve the alkaloidal residue in 10 mils of a mixture of 1 mil of diluted sulphuric acid and 9 mils of distilled water, by aid of a gentle heat, and filter the solution through a small filter, not exceeding 5 cm. in diameter, into a separator. Wash the beaker and filter with successive small portions of acidulated water, until a few drops of the filtrate give no test for caffeine when tested with iodine T.S. To the mixed acid washings, add a slight excess of ammonia water, and shake out the caffeine with successive portions of chloroform, collecting the chloroformic solutions in a tared flask or beaker. Evaporate or distil off the chloroform at a temperature not exceeding 75° C. (167° F.) and add to the residue 5 mils of ether. Evaporate off the ether cautiously, then dry the residue to constant weight at a temperature not exceeding 80° C. (176° F.) and add 0.0025 Gm. to the final weight of caffeine to replace that lost in the petroleum benzin washing. The weight represents the amount of caffeine in 5 Gm. of Coffee.

N. F. Preparation.—Fluidextractum Coffeæ.

Uses.—It is chiefly used for its flavor and stimulating effects.

CONIUM. N. F. Conium

(U. S. P. VIII)

[POISON HEMLOCK]

The full grown, but unripe fruit of *Conium maculatum* Linné (Fam. *Umbelliferæ*), carefully dried and preserved, and yielding not less than 0.5 per cent. of coniine. After being kept for more than two years, Conium is unfit for use.

Official Description.—Broadly ovoid, greenish-gray, the two mericarps of most of the fruits separated, each about 3 mm. in length and about 1.5 mm. in diameter, ovoid, somewhat curved, the inner, flattened side marked by a deep longitudinal groove, the outer, convex side with five, pale yellow, somewhat crenate ribs, the intervening surfaces wrinkled but otherwise smooth, pericarp without oil tubes.

Odor and Taste.—Odor slight, but when triturated with a solution of potassium hydroxide, strong, disagreeable, and mouse-like; taste characteristic, disagreeable, afterwards somewhat acrid.

Tests for Identity and Purity.—Transverse sections of the mericarp, when examined under the microscope, exhibit a pentangular outline, the angles projecting and forming the ribs, four of the sides being almost equal in length, the fifth or commissural side being about twice as long as one of the dorsal sides and usually concave near the middle; a distinct fibro-vascular bundle at each angle composed of thick-walled fibers about 0.013 mm. in diameter and a few tracheæ; epidermis consisting of one layer of cells which are sometimes slightly centrifugally developed, hairs are absent; pericarp thin, without vittæ, enclosing a single seed and extending inwardly on the commissural side for about one-third the diameter of the section; the inner epidermis of the pericarp composed of two layers of cells with yellowish-brown walls, the outer layer with cells from 0.06 mm. to 0.12 mm. in tangential length and with thickened radial and inner walls, the inner layer with thin-walled cells from 0.03 to 0.06 mm. in tangential length and about 0.03 mm. in radial diameter; the seed-coat composed of small, thick-walled cells about 0.015 mm. in radial diameter; often obliterative; a large endosperm or central portion being somewhat pentangular-rounded in outline, with a deep channel on the commissural side and composed of polygonal parenchyma cells; the latter contain globules of fixed oil and aleurone grains with rosette aggregates of calcium oxalate.

The powdered drug is greenish-gray and, when examined under the microscope, exhibits numerous angular or rounded, light-colored fragments of endosperm tissue, composed of parenchyma cells containing fixed oil, aleurone grains and rosette aggregates of calcium oxalate, the latter from 0.002 to 0.006 mm. in diameter; a few more or less curved groups of lignified fibers; fragments of the seed-coat with yellowish-brown walls; a few rounded starch grains about 0.005 mm. in diameter; spiral or annular tracheæ few; numerous oil globules on mounting the powder in hydrated chloral T.S.

Conium yields not more than 8 per cent. of ash.

Assay.—Place 15 Gm. of Conium, in No. 40 powder, in a 250-mil Erlenmeyer flask, add 150 mils of purified petroleum benzin and then 15 mils of solution of sodium hydroxide, insert the stopper securely, and shake the flask vigorously at frequent intervals during six hours. Allow the mixture to settle and decant 100 mils of the clear benzin solution (representing 10 Gm. of the drug) into a separator; extract the alkaloid by shaking with successive portions of weak hydrochloric acid until a few drops of the last washing give no precipitate with iodine T.S. Collect the acid washings and concentrate by evaporation on a water bath to 10 mils, cool and transfer the liquid to a separator, then cautiously add sodium carbonate in excess. Extract the alkaloid by shaking out with successive portions of 15 mils each of purified petroleum benzin. Separate the benzin washings and filter into a beaker. Then add exactly 10 mils of tenth-normal sulphuric acid V.S. and stir thoroughly for two minutes so as to mix the acid and benzin solution. Evaporate the benzin layer in a current of warm air, at a temperature not exceeding 60° C. (140° F.) and as soon as the benzin has disappeared, cool, add five drops of cochineal T.S. or methyl red T.S. and titrate the acid solution with fiftieth-normal potassium hydroxide V.S. Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 0.0126 Gm. of coniine. Calculate the amount of coniine neutralized by the acid, and multiply the result by ten to obtain the percentage of coniine in the drug.

N. F. Preparations.—Extractum Conii; Fluidextractum Conii.

Conium contains *coniine,* $C_8H_{17}N$, *conhydrine* or *oxyconiine,* $C_8H_{17}ON$, and *pseudoconhydrine, ethyl-piperidine,* and *methylconiine,* $C_8H_{16}CH_3N$; also a little volatile oil and fixed oil. Coniine is a liquid volatile alkaloid, and contains no oxygen. It was the first alkaloid to be made by synthesis. Its odor resembles that of the urine of mice. It is soluble in water, alcohol, and ether.

Uses.—Conium is used as a narcotic and sedative. Dose, three grains (0.2 Gm.).

COPTIS. N. F. Coptis

[GOLDTHREAD]

The dried plant of *Coptis trifolia* (Linné) Salisbury (Fam. *Ranunculaceæ*).

It contains the yellow alkaloid *berberine* and a white alkaloid called *coptine.*

Official Description.—In loose, matted masses consisting of long, much-branched rhizomes and their small roots, together with the leaves. Rhizomes orange or golden-yellow; leaves evergreen, long and slenderly petioled, trifoliate, the segments broadly obovate-cuneate, crenately lobed and toothed with sharp-pointed teeth, prominently veined, smooth, coriaceous, dark green and shining but often drying to a dull brownish hue; flowers, if present, small, solitary, terminating slender scapes, sepals five to seven, oblong, obtuse, deciduous; petals five to six, pale yellow, small club-shaped; stamens numerous.

Odor and Taste.—Odor faint; taste purely bitter without astringency.

Tests for Identity and Purity.—The powdered drug is yellowish-green and, when examined under the microscope, exhibits numerous, mostly simple, starch grains, somewhat rounded, up to 0.007 mm. in diameter; fragments of leaf epidermis, composed of cells with wavy vertical walls and broadly elliptical stomata, the latter up to 0.024 mm. in length; fragments of the nerved scales from the nodes, composed of cells with yellow walls; leaf parenchyma cells containing chloroplastids; few simple, thick-walled hairs from the midrib of the leaf, from 0.035 to 0.075 mm. in length; elongated, epidermal cells from the roots having yellow walls and filled with reddish contents; fragments of epidermal and sub-epidermal cells from the rhizome, similar to those from the root, but without reddish contents, often filled with a yellowish content; groups of elongated parenchyma cells about 0.06 mm. in length and about 0.01 mm. in width, many being filled with starch grains; tracheæ with bordered pores or spiral markings, about 0.02 mm. in width; narrow, thin-walled, porous sclerenchyma fibers.

Coptis yields not more than 8 per cent. of ash.

N. F. Preparation.—Fluidextractum Coptis.

Uses.—It is used as a tonic and in mouth-washes for canker-sores and as a gargle for sore throat. Dose, thirty grains (2 Gm.).

CORYDALIS. N. F. Corydalis

[**Coryd.**—TURKEY CORN SQUIRREL CORN]

The dried tubers of *Bicuculla canadensis* (Goldie) Millspaugh, usually somewhat mixed with the dried bulb-like portions of *Bicuculla Cucullaria* (Linné) Millspaugh (Fam. *Fumariaceæ*), and without the presence of more than 5 per cent. of other parts of the plants or other foreign matter.

It contains *corydaline,* $C_{18}H_{19}O_4N$, *fumaric acid,* bitter extractive and acid resin.

Official Description.—The tubers are spheroidal and frequently vertically depressed, the flattened surface more or less concave, up to 15 mm. in diameter; usually single, rarely two or more in a cluster; externally, minutely pitted or nearly smooth; grayish-brown, grayish-black, or amber-colored and more or less translucent; one of the flattened surfaces with a triangular scar from detached roots, the other usually with remains of the slender rhizome; fracture, hard and horny, exhibiting a yellowish, waxy interior, or somewhat tough and granular, exhibiting a yellowish-white interior.

The grains of the granulate bulb of *Bicuculla Cucullaria* are ovoid or triangular-ovoid and up to 12 mm. in length; the larger grains distinctly concave on one surface, with a scar at the apex from the detached petiole, and usually attached to the short root-stock in clusters of three; the smaller grains usually separated from the root-stock, with an acute apex and a scar at the base; externally, yellowish- or grayish-brown, usually translucent; fracture hard and horny, exhibiting a grayish, waxy interior, or granular and tough, exhibiting a whitish interior.

Odor and Taste.—Nearly odorless; taste slightly bitter.

Tests for Identity and Purity.—The powdered drug is light yellow or yellowish-gray and, when examined under the microscope, exhibits numerous oval, ovoid or oblong, simple starch grains, the broad end of the grain sometimes truncate, up to 0.06 mm. in length and frequently with a cleft or horseshoe-shaped fissure in the small end of the grain; occasionally in two-compound grains; altered starch grains up to 0.09 mm. in length; numerous angular or rounded parenchyma cells isolated or in groups and containing more or less altered starch grains the outlines of which are indistinct; tracheæ few with reticulate, simple; pores, annular or spiral markings; fragments of epidermal cells with thin brownish walls; sclerenchyma fibers very few or absent; few characteristic sclerotic cells from the root-stock of *Bicuculla Cucullaria*, irregular in outline, mostly elongated up to about 0.75 mm. in length and 0.1 mm. in width, walls heavily lignified and about 0.02 mm. in thickness and porous, occurring isolated or in groups of from two to four; very few sclerotic cells from the rhizome of *Bicuculla canadensis*, mostly isodiametric, uniformly smaller than in *Bicuculla Cucullaria* and with walls about 0.012 mm. in thickness, not distinctly irregular in outline; very few rosette aggregates of calcium oxalate, up to 0.02 mm. in diameter, from the portions of rhizome of *Bicuculla canadensis.*

An infusion prepared by placing 5 Gm. of powdered Corydalis in 100 mils of hot distilled water, stirring occasionally during ten minutes and then filtering, is of a light amber color, and gives a precipitate with potassio-mercuric iodide T.S. and a dark blue color with iodine T.S.

Corydalis yields not more than 8 per cent. of ash.

N. F. Preparations.—Elixir Corydalis Compositum (from Fluidextract); Fluidextractum Corydalis; Fluidextractum Stillingiæ Compositum.

Uses.—It is used as a tonic and antisyphilitic. Dose, ten grains (0.65 Gm.).

DELPHINIUM. N. F. Larkspur Seed

[Delphin.]

The dried seeds of *Delphinium Consolida* Linné or of *Delphinium Ajacis* Linné (Fam. *Ranunculaceæ*), without the presence of more than 5 per cent. of foreign matter.

Its constituents are similar to those obtained from staphisagria. The most important alkaloid is *delphinine*, $C_{31}H_{49}O_7N$; there is also present *delphisine*, a decomposition product of delphinine, and *delphinoidine*, $C_{25}H_{42}O_4N$, and other minor constituents have also been claimed to be present.

Official Description.—Irregularly tetrahedral, or by pressure somewhat triangulate, acute at one end, obtuse or rounded at the other, about 2 mm. in length and equally broad or slightly narrower, surface black or blackish-brown, deeply and narrowly furrowed, the furrows intersecting so as to give a sharply tuberculate appearance to the surface, with serrate edges; testa crustaceous; kernel whitish, fleshy; embryo small, in fleshy endosperm.

Odor and Taste.—Odor very faint; taste bitter, afterwards biting and acrid.

Test for Identity and Purity.—Larkspur Seed yields not more than 7 per cent. of ash.

N. F. Preparation.—Tinctura Delphinii.

Uses.—It is used almost entirely for the destruction of lice and the itch-mite. It may be employed as an ointment or as a lotion or tincture.

DULCAMARA. N. F. Bittersweet
[Dulcam.]

The dried stems and branches of *Solanum Dulcamara* Linné (Fam. *Solanaceæ*).

It contains the alkaloid *solanine*, $C_{42}H_{87}O_{15}N$, also the glucoside *dulcamarin*. *Solanidine*, $C_{26}H_{41}O_2N$, is a decomposition product.

Official Description.—In short sections about 5 mm. or less in thickness, cylindraceous, somewhat angular, longitudinally striate, more or less warty, usually hollow in the center; bark thin, externally pale greenish, or light greenish-brown, glabrous, marked with alternate leaf scars, internally green, the greenish or yellowish wood occurring in one or two concentric rings.

Odor and Taste.—Odor slight; taste bitter, afterwards sweet.

Tests for Identity and Purity.—The powder is greenish-yellow and, when examined under the microscope, exhibits tracheæ up to 0.05 mm. in diameter and with bordered pores; lignified wood-fibers with few pores; non-lignified bast-fibers with walls up to 0.02 mm. in thickness; fragments of cork cells; few simple, unicellular hairs up to 0.8 mm. in length, and with the lamina distinct in the lower portions only; few starch grains, spheroidal, up to 0.012 mm. in diameter; sphenoidal crystals of calcium oxalate numerous, up to 0.007 mm. in length.

Bittersweet yields not more than 6 per cent. of ash.

N. F. Preparation.—Fluidextractum Dulcamaræ.

Uses.—It is used as a diuretic and sedative. Dose, one drachm (4 Gm.).

IGNATIA. N. F. Ignatia
[Ignat.—Saint Ignatius Bean Ignatia Amara]

The dried ripe seeds of *Strychnos Ignatii* Bergius (Fam. *Loganiaceæ*), yielding not less than 2 per cent. of the alkaloids of Ignatia.

Its constituents are similar to those from nux vomica, although the alkaloids are usually present in smaller amounts.

Official Description.—Heavy, hard, angularly ovate with obtuse angles, from 20 to 30 mm. in length and about 15 mm. in breadth and thickness; externally grayish or reddish-black, nearly smooth with few or no hairs; fracture granular and translucent in small fragments; a small, irregular cavity in the center.

Odor and Taste.—Nearly inodorous and intensely bitter.

Tests for Identity and Purity.—The powder is grayish-brown and, when examined under the microscope, exhibits thin cells of the epidermis and the subjacent layer of the seed-coat, polygonal cells with thickened, pitted walls; hairs characteristic, spreading and thickened at the base and having linear markings; endosperm tissue, the outer cells small, contents granular, the inner larger, with thickened walls; lumen irregular in size and shape.

Ignatia yields not more than 4 per cent. of ash.

Assay.—Introduce 15 Gm. of Ignatia, in No. 40 powder, into a 250-mil flask and add 150 mils of a mixture of chloroform, 1 volume, and ether, 2 volumes. Stopper the flask, shake it well and allow it to stand ten minutes, then add 10 mils of ammonia water, shake the flask vigorously every ten minutes during two hours and allow it to stand for ten hours. Now add 25 mils of distilled water, again shake the flask well, and, when the drug has settled, decant 100 mils of the solution, representing 10 Gm. of Ignatia. Filter the solution through a pledget of purified cotton into a separator, and rinse the graduate and cotton with a little ether. Completely extract the alkaloids from the solution by shaking out repeatedly with weak sulphuric acid. Collect the acid washings in a separator, add ammonia water until the solution is decidedly alkaline to litmus, and completely extract the alkaloids by shaking out repeatedly with chloroform. Evaporate the combined chloroform washings to dryness, dissolve the alkaloids from the residue in exactly 10 mils of tenth-normal sulphuric acid V.S., and titrate the excess of acid with fiftieth-normal potassium hydroxide V.S., using cochineal T.S. or methyl red T.S. as indicator.

Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 36.4 milligrammes of the alkaloids of Ignatia.

N. F. Preparations.—Extractum Ignatiæ; Tinctura Ignatiæ.

Uses.—Similar to nux vomica. Dose, one grain (0.065 Gm.).

KOLA. N. F. Kola
[COLA]

The dried cotyledons of several species of *Cola* Schott and Endlicher (Fam. *Sterculiaceæ*), yielding not less than 1.5 per cent. of caffeine.

The chief constituent is *caffeine,* with small amounts of *theobromine.* It also contains *kolatin, kolanin,* tannic acid, fat, volatile oil, etc.

Official Description.—Irregularly plano-convex, broadly oval, or approaching circular in outline, from 2.5 to 5 cm. in length, or triquetrous; heavy, hard and tough; brown, with the outer surfaces slightly wrinkled, the inner surfaces lighter and smoother; edges slightly incurved and sharp.

Odor and Taste.—Odorless; taste slightly astringent.

Tests for Identity and Purity.—The powdered drug is reddish-brown and, when examined under the microscope, exhibits numerous starch grains, some of which show alteration, the normal grains up to 0.045 mm. in diameter, the smaller ellipsoidal or spherical, the larger ellipsoidal or irregularly oblong and occasionally with a protuberance on one side; many of the larger grains show lamellæ and a circular point of origin of growth or a fissure through the center, and a distinct cross when examined with the polarizing microscope; parenchyma cells numerous, about 0.065 mm. in diameter, with reddish-brown walls.

Assay.—Introduce 6 Gm. of Kola, in No. 60 powder, into a flask and add 120 mils of chloroform and 6 mils of ammonia water. Stopper the flask, shake it frequently for half an hour, then let it stand four hours. Again shake the flask vigorously and, when the drug has settled, filter the liquid rapidly through a pledget of purified cotton and collect 100 mils of the filtrate representing 5 Gm. of Kola. Evaporate the clear filtrate to dryness and dissolve the residue in 5 mils of weak sulphuric acid with the aid of a gentle heat. When the liquid has cooled, filter it into a separator and wash the container and filter with several small portions of distilled water. Now add ammonia water until the liquid is distinctly alkaline to litmus and shake out the alkaloid with successive portions of chloroform until completely extracted, as shown by testing with iodine T.S. Evaporate the united chloroform solutions and dry the residue to constant weight at 80° C. (176° F.). The weight is the amount of caffeine from 5 Gm. of Kola.

Kola yields not more than 3 per cent. of ash.

N. F. Preparation.—Fluidextractum Kolæ.

Uses.—It is employed for the same purposes as caffeine. It is also used in cardiac weakness and topical diarrhœa. Dose, one drachm (4 Gm.).

PAPAVERIS FRUCTUS. N. F. Poppy Capsules
[Papav. Fruct.]

The dried, fully grown, unripe fruit of *Papaver somniferum* Linné (Fam. *Papaveraceæ*). Separate and reject the seeds before using the fruit in pharmaceutical preparations.

It contains a small amount (about 0.2 per cent.) of *morphine; narcotine, narceine, papaverine, rhœadine, codeine* and *meconic acid* have been reported as being present in minute amounts.

Official Description.—Globular or ovoid, usually from 3 to 3.5 cm. in diameter, but varying in size, more or less sunken or depressed on the sides, contracted at the base into a sort of neck immediately above a tumid ring at the point of attachment with the stalk; crowned at the summit with the seven- to fifteen-rayed stigma disk; outer wall of pericarp smooth, hard, grayish-yellow to brownish-yellow, often marked with black spots; interior surface rugose, finely striated transversely, and bearing thin, brittle, membranaceous placentæ which extend from the sutures toward the center, and bear on their faces and edges numerous minute, conspicuously reticulated, reniform white seeds.

Odor and Taste.—Odorless; taste slightly bitter.

Tests for Identity and Purity.—Macerate 1 Gm. of the powdered Capsules for two hours with 10 mils of water containing 1 per cent. of hydrochloric acid, and filter; the filtrate yields distinct precipitates with iodine T.S. and with potassio-mercuric iodide T. S.

The powdered drug is grayish-yellow, and, when examined under the microscope, exhibits fragments of the epicarp composed of thick-walled polygonal cells, the cells of the outer layer non-porous, up to 0.05 mm. in diameter and with occasional stomata, the latter up to 0.035 mm. in length; the cells of the inner layer of the epicarp often with numerous simple pores; portions of the soft, spongy sarcocarp consisting of isodiametric or irregular parenchyma and branching milk ducts, the latter up to 0.06 mm. in width, of variable length and with thin, non-porous walls; fragments of the inner wall of the pericarp and the outer walls of the placental tissue composed of polygonal or somewhat elongated cells with porous walls, up to 0.06 mm. in width and up to 0.3 mm. in length, the walls of the latter cells often slightly lignified; spiral and annular tracheæ up to 0.035 mm. in width and reticulate tracheæ up to 0.06 mm. in width; sclerenchyma cells few, with simple or oblique pores; starch grains few, small, somewhat rounded; fragments of the reticulately pitted seed-coat very few or absent.

Poppy Capsules yield not more than 10 per cent. of ash.

N. F. Preparation.—Syrupus Papaveris.

Uses.—A narcotic similar to opium. Dose, fifteen grains (1 Gm.).

PAREIRA. N. F. Pareira

(U. S. P. VIII)

[PAREIRA BRAVA]

The dried roots of *Chondodendron tomentosum* Ruiz et Pavon (Fam. *Menispermaceæ*), without the presence of more than 5 per cent. of stems or other foreign matter.

This root contains an alkaloid usually called *pelosine,* $C_{18}H_{21}O_3N$; it also contains starch, gum, tannin and *phlobaphene.* Pelosine has been proved to be identical with *buxine* and *bebeerine,* alkaloids obtained from *Buxus sempervirens* and *Nectandra Rodiæi.*

Official Description.—Nearly cylindrical, more or less tortuous, of variable length and from 1 to 6 cm. in diameter; externally brownish-black or blackish-brown with transverse ridges on knot-like projections, occasionally fissured and longitudinally wrinkled or even furrowed; hard, heavy and tough; when freshly cut having a waxy luster; the transverse surfaces exhibiting several successive excentric and distinctly radiate concentric zones of projecting, secondary fibro-vascular bundles, each from 2 to 4 mm. in width, and separated by distinct concentric zones of parenchyma and stone cells. Stems deeply furrowed, grayish in color, usually covered with foliaceous patches of lichens bearing their blackish apothecia; internally grayish-yellow, with a prominent development of wood with a tendency to separate fibro-vascular bundles and without a waxy luster.

Odor and Taste.—Odor slight; taste very bitter.

Tests for Identity and Purity.—The powder is dark brown, containing numerous starch grains and a few woody fragments; starch grains mostly simple, occasionally unequally two- to four-compound, the individual grains ellipsoidal or oblong, 0.005 to 0.02 mm. in diameter and occasionally with central clefts or irregular markings; fragments with large, wide tracheæ, the walls with numerous slit-like pores and associated with long, thick-walled, strongly lignified, porous wood-fibers; stone cells in small groups, with thick porous walls and in form resembling those of the fruits and seeds; fragments of starch-bearing parenchyma; the cells of the root being thick-walled, strongly lignified and with large, longitudinal, elliptical pores; occasional fragments of blackish-brown cork.

Pareira yields not more than 5 per cent. of ash.

N. F. Preparation.—Fluidextractum Pareiræ.

Uses.—Pareira is used as a tonic, diuretic, and aperient. The dose is thirty grains (2 Gm.).

PASSIFLORA. N. F. Passion Flower

[**Passiflor.**—PASSION VINE]

The dried herbage of *Passiflora incarnata* Linné (Fam. *Passifloraceæ*), collected after some of the berries have matured.

An alkaloid has been reported, but the constituents have not been carefully studied.

Official Description.—Stems glabrous or slightly pubescent above, striate, from 6 to 8 mm. in diameter, of variable length, woody, hollow, the cavity about one-half the diameter; bark very thin, greenish or purplish; wood very porous and bordered on the inner side by a thin layer of pith; fracture of the wood uneven, of the stem smooth, of the bark coarsely fibrous. Leaves more or less broken in drying, rather thick, glabrous or often pubescent, when entire nearly orbicular in outline, base cordate, deeply three- to five-lobed, lobes ovate, acute, finely serrate, petioles from 1 to 5 cm. in length, with two glands near the summit. Tendrils numerous and closely coiled. Flowers solitary, axillary, peduncles as long as the petioles, usually three-bracted; calyx cup-shaped, four to five lobes; lobes linear, imbricated, cuspidate, corona of the fresh flowers purplish; petals four to five, yellow; ovary oblong, stalked; stamens monadelphous in a tube about the stalk of the ovary, separated above, anthers narrow, versatile. Fruit from 4 to 5 cm. in length, an ovoid, many-seeded berry; externally green or yellow, shriveled and wrinkled; seeds flat, ovate, yellowish to brown arilled.

Odor and Taste.—Taste and odor slight.

Test for Identity and Purity.—Passion Flowers yield not more than 12 per cent. of ash.

N. F. Preparation.—Tinctura Passifloræ.

Uses.—It has been used as an application in hemorrhoids, erysipelas, and burns; also internally in neuralgia. It is not often used to-day. Dose, three grains (0.2 Gm.).

SCOPARIUS. N. F. Scoparius

(U. S. P. VIII)

[**Scopar.**—Broom Tops]

The dried tops of *Cytisus scoparius* (Linné) Link (Fam. *Leguminosæ*).

Scoparius contains *sparteine,* a colorless liquid alkaloid, having the composition $C_{15}H_{26}N_2$. The sulphate of this alkaloid is official (see page 1378). It also contains the glucoside *scoparin,* $C_{21}H_{22}O_{10}$, which probably represents the diuretic and purgative action of the drug.

Official Description.—Thin, flexible, branched twigs, from 2 to 3 mm. in thickness, five-angled; externally dark green, nearly glabrous, with numerous reddish-brown cork patches; internally yellowish, fracture short-fibrous, that of thicker pieces tough and splintery, upper leaves sessile, with often only one obovate leaflet present in small amount or absent.

Odor and Taste.—Odor slight, on bruising more distinct and peculiar; taste disagreeable, bitter.

Test for Identity and Purity.—Scoparius yields not more than 5 per cent. of ash.

N. F. Preparation.—Fluidextractum Scoparii.

Uses.—The dose of scoparius in dropsical complaints is fifteen to thirty grains (1 to 2 Gm.).

SOLANUM. N. F. Solanum

[**Solan.**—Horse-nettle Berries]

The air-dried ripe fruit of *Solanum carolinense* Linné (Fam. *Solanaceæ*).

It contains two alkaloids, *solanine* and *solanidine,* also fat, resin, and volatile oil.

Official Description.—Globose, slightly depressed, somewhat shriveled and wrinkled in drying, from 0.8 to 2 cm. in diameter, orange-yellow, glabrous, fleshy, two-celled, many-seeded, calyx and pedicel usually persistent; calyx stellate pubescent, deeply five-lobed, the lobes ovate or ovate-lanceolate, acuminate and enclosing half or more of the berry; seeds orbicular, flat, yellow, smooth, shining.

Odor and Taste.—Odor pepper-like; taste bitter and acrid.

Test for Identity and Purity.—Solanum yields not more than 6 per cent. of ash.

N. F. Preparation.—Fluidextractum Solani.

Uses.—It has been employed in epilepsy. Its use is similar to that of dulcamara. Dose, one drachm (4 Gm.).

Unofficial Drugs containing Alkaloids

Akazga (Boundou, Quai, Ikaga, Icaya)	An ordeal poison, used in a district on the west coast of Africa. The alcoholic extract acts similarly to nux vomica
Alstonia Constricta **Australian Fever Bark**	The bark of *A. constricta*, found in Australia. It contains *alstonine*, which is very bitter
Chelidonium **Celandine.** **U. S. P. 1890**	The entire plant, *Chelidonium majus* Linné (Fam. *Papaveraceæ*). It contains *chelerythrine*, *chelidonine*, *chelidoxanthin*, and *chelidonic acid*. Used as a diuretic in doses of forty grains (2.6 Gm.)
Coca **Erythroxylon.** **U. S. P. VIII**	The dried leaves of *Erythroxylon Coca* Lamarck (Fam. *Erythroxylaceæ*), known commercially as Huanuco Coca, or of *E. Truxillense* Rusby, known commercially as Truxillo Coca. Yielding not less than 0.5 per cent. of the ether-soluble alkaloid when assayed as directed in the U. S. P. VIII. It contains *Cocaine*, $C_{17}H_{21}O_4N$, and *hygrine* and *coca-tannic acid*. It is used as a nerve stimulant in thirty- to sixty-grain doses (2 to 4 Gm.). As its preparations rapidly deteriorate, the drug and its preparations were all deleted
Colchici Flores **Colchicum Flowers**	The flowers of *Colchicum autumnale*, found in Europe. They contain a large percentage of *colchicine*
Coptis Teeta **East Indian Goldthread**	The rhizome of *C. Teeta*, found in the East Indies. It contains a very large percentage of *berberine*
Curare **Wourari**	An extract made by South American Indians from plants belonging to the genus *Strychnos*. It contains an extremely poisonous alkaloid, named *curarine*
Cytisus Laburnum **Laburnum**	Poisonous, narcotic. It contains *cytisine* ($C_{20}H_{27}ON_3$) and *laburnine*
Dita **Dita Bark**	From the bark of *Alstonia scholaris*, found in the Philippine Islands. It contains $^1/_{50}$ per cent. of a bitter alkaloid, *ditamine*, and 2 per cent. of *ditain*, an uncrystallizable bitter substance
Duboisia **Duboisia**	The leaves of *D. myoporoides*, found in Australia. It contains a very poisonous alkaloid, *duboisine*, which is colored reddish-brown by sulphuric acid
Ephedra Vulgaris	A cardiac stimulant and local mydriatic. It contains the alkaloid *ephedrine*
Erythrophlœum **Sassy Bark**	The bark of *E. guineense*, found in Africa. It contains the colorless alkaloid *erythrophleine*. Emetic, narcotic, and astringent. Dose of the extract, two-tenths to three-tenths grain (0.015 to 0.02 Gm.)
Eschscholtzia Californica **Chamisso**	Soporific and analgesic. It contains a glucoside and an alkaloid, said to be *morphine*. The extract has been given in doses commencing with twelve and three-tenths grains (0.8 Gm.), increasing to one hundred and eighty-five grains (12 Gm.) a day
Glaucium **Horn Poppy**	The plant of *G. luteum*. It contains the alkaloids *sanguinarine*, *glaucine*, and *glaucopicrine*
Gloriosa Superba	An acrid, narcotic poison. It contains two resins and a very poisonous bitter principle, *superbine*
Isopyrum Thalictroides	It contains two alkaloids, *isopyrine* and *pseudo-isopyrine*
Manaca	A portion of the root and stem of *Francisca uniflora*, a Brazilian plant. Antirheumatic, given in the form of fluidextract, in the dose of ten to thirty drops, three times a day
Mandragora Officinalis **Mandrake**	Anæsthetic. It contains an alkaloid, *mandragorine*, and another alkaloid, both of which possess mydriatic properties
Menispermum **Yellow Parilla** **Canadian Moonseed.** **U. S. P. 1890**	The rhizome and roots of *Menispermum canadense* Linné (Fam. *Menispermaceæ*). It contains *menispine*, *berberine*, resin, etc. It is alterative and tonic. Dose, twenty to forty grains (1.3 to 2.6 Gm.)
Muawin Bark	An ordeal poison. It contains an alkaloid, *muawinine*
Papaya **Papaw**	The leaves of the *Papaw* tree contain *carpaine*, a cardiac depressant
Peganum Harmala	The seed contains about 4 per cent. of alkaloid, two-thirds of which is *harmaline*. It is a convulsant poison, has been used as a diaphoretic, an emmenagogue and an anthelmintic
Sophora Speciosa	The poisonous seeds of this tree contain a volatile liquid alkaloid, *sophorine*
Sabadilla Semen **Sabadilla Seed**	The seeds of *Veratrum Sabadilla*. These seeds are the commercial source of *Veratrine*. Commercial *veratrine* is a mixture of alkaloids, made up of *cevadine*, *cevadilline*, *veratridine*, *sabadine* and *sabadinine*
Scopola **Scopola.** **U. S. P. VIII**	This rhizome when assayed properly yields not less than 0.5 per cent. of mydriatic alkaloids. Contains *scopolamine*, *hyoscyamine* and *atropine*. Used as a narcotic and mydriatic. Dose, ¾ grain (0.045 Gm.)
Stramonii Semen **Stramonium Seed.** **U. S. P. 1890**	The seed of *Datura Stramonium* Linné (Fam. *Solanaceæ*). Similar to the leaves in action and constituents (see page 1353). It contains in addition about 25 per cent. of fixed oil
Tabacum **Tobacco. U. S. P. 1890**	The commercial, dried leaves of *Nicotiana Tabacum* Linné (Fam. *Solanaceæ*). It contains *nicotine*, a liquid alkaloid, very acrid and poisonous. Tobacco is sedative and emetic in doses of one to five grains (0.065 to 0.32 Gm.)
Yohimboa Bark	The bark of the species *Tabeimontana* containing *yohimbine*. Yohimbine is used as an aphrodisiac
Xanthorrhiza **Yellow Root**	Tonic. Dose, forty grains (2.6 Gm.). It contains *berberine*

Unofficial Alkaloids and their Salts, with Allied Products

Alstonine, $C_{21}H_{20}O_4N_2 + 3\frac{1}{2}H_2O$	From the bark of *Alstonia constricta.* A brownish-yellow, amorphous powder, readily soluble in alcohol
Anagyrine, $C_{14}H_{18}O_2N_2$	A yellowish, amorphous, hygroscopic, poisonous alkaloid, from *Anagyris fœtida.* Soluble in water, alcohol, and ether
Analgen (Ortho-ethyoxy-anamonobenzoylamido-chinoline), $C_{18}H_{16}O_2N_2$	Antipyretic and antirheumatic. Dose, eight to fifteen grains (0.5 to 1 Gm.), repeated, if necessary, to seventy-five grains (4.86 Gm.) a day
Antispasmin (Narcein Sodium-Sodium Salicylate) $C_{23}H_{26}O_8N.Na + 3C_6H_4(OH)COONa$	Hypnotic and analgesic. Dose, one-half to one grain (0.03 to 0.065 Gm.)
Aspidospermine, $C_{22}H_{30}O_2N_2$	From the bark of *Aspidosperma Quebracho.* It is a weak base, forming amorphous salts. The hydrochloride is given in doses of one-thirtieth to one-twentieth of a grain (0.002 to 0.003 Gm.)
Beberine, $C_{18}H_{21}O_3N$	From the bark of *Nectandra Rodiœi.* A pale yellow, amorphous powder, of a resinous aspect, inodorous, very bitter, very slightly soluble in water, inflammable, and of an alkaline reaction. ***Beberine sulphate*** is given in doses of two to five grains (0.13 to 0.32 Gm.)
Benzoyl Ecgonine, $C_{16}(H).H_{18}O_4N$, or $C_9H_{14}(C_7H_5O)O_3N$	Cardiac stimulant. Prepared by heating cocaine in aqueous solution to decomposition
Benzoyl Tropeine, $C_{15}H_{19}O_2N + 2H_2O$	Local anæsthetic
Berberine, $C_{20}H_{17}O_4N$	From the bark of the root of *Berberis vulgaris* and others. It occurs in minute yellow crystals, has a bitter taste, is soluble in 100 parts of cold water, and insoluble in ether. Its medicinal action is similar to that of quinine. Dose, one to eight grains (0.065 to 0.5 Gm.)
Betaine Trimethyl-glycoll	An alkaloid found in the juice of the sugar beet
Blennostasine	Supposed to be a derivative of a cinchona alkaloid. Used in hay fever, influenza, and colds, in doses of fifteen to sixty grains (1 to 4 Gm.)
Boldine	From the leaves of *Peumus Boldus.* It imparts to water a bitter taste, is soluble in alcohol, ether, chloroform, etc., and is colored red by nitric and sulphuric acids. The yield of alkaloid is about $^1/_{10}$ per cent.
Buxine	From the bark of *Buxus sempervirens.* It is identical with the beberine of nectandra bark
Chelerythrine	From *Chelidonium majus.* This alkaloid is identical with ***sanguinarine.*** It is an acrid poison
Chinoidine (Quinoidine)	A mixture of alkaloids, mostly amorphous, obtained as a by-product in the manufacture of the crystallizable alkaloids from cinchona. Dose, five to thirty grains (0.32 to 2 Gm.)
Chinol, Quinoline mono-hypochlorite, $C_9H_6N.Cl.O$	Antipyretic and analgesic. Dose, three to five grains (0.2 to 0.32 Gm.)
Chinoline (Quinoline, Leucoline), C_9H_7N	An artificial alkaloid. A colorless, oily liquid. Sp. gr. 1.081 at 10° C. (50° F.). Antipyretic and antiseptic
Chlorogenine	Identical with ***alstonine*** (see above)
Cicutine	From *Cicuta virosa.* A volatile alkaloid. An acrid narcotic and poison
Cinchonidinæ Salicylas, Cinchonidine Salicylate, $C_{19}H_{22}ON_2C_7H_6O_3$	Antirheumatic. Dose, fifteen to twenty grains (1 to 1.3 Gm.) a day
Cinchonine, $C_{19}H_{22}ON_2$ U. S. P. 1890	An alkaloid obtained from the bark of various species of Cinchona. Insoluble in water. Used in making elixirs, etc., as it is soluble in alcohol
Conhydrine, $C_8H_{17}ON$	From *Conium maculatum.* It occurs in pearly, iridescent plates, which are easily fusible; odor similar to that of coniine
Coniine, $C_8H_{17}N$	From *Conium maculatum.* A volatile alkaloid, inflammable, strong alkaline reaction, strong odor, soluble in water, alcohol, ether, chloroform, etc. Used as an antispasmodic. Dose, one-fourth of a grain (0.015 Gm.). ***Coniine hydrobromide*** is given in doses of one-sixteenth of a grain (0.004 Gm.)
Corydaline, $C_{22}H_{27}O_4N$	From the tubers of *Dicentra canadensis.* A white, amorphous powder; its solution has a very bitter taste; it is a tertiary base
Curarine, $C_{18}H_{35}N$?	From *curare.* It occurs in colorless prisms having a very bitter taste. It is colored red by nitric acid
Cytisine, $C_{11}H_{14}ON_2$	From *Cytisus Laburnum.* It occurs in white crystals, is inodorous, and has a bitter, somewhat caustic taste, and an alkaline reaction. Soluble in water and alcohol. It is colored orange-yellow by nitric acid
Daturine	See page 1354. Dose, one-sixty-fourth of a grain (0.001 Gm.)
Delphinine, $C_{22}H_{35}O_6N$	From the seed of *Delphinium Staphisagria.* It occurs in flat prisms; taste bitter, followed by persistent tingling. Nearly insoluble in water
Duboisine	From several species of *Duboisia.* It crystallizes in fine colorless needles. Used as a substitute for atropine. Dose, one sixty-fourth of a grain (0.001 Gm.)
Erythrophleine Hydrochloride	Obtained from *Erythrophlœum guineense* (Sassy bark). Used in place of cocaine. Dose, one-eighth of a grain (0.008 Gm.)
Ethyl-oxy-Caffeine	Called also Ethoxycaffeine. Given in migraine, in doses of six to eight grains (0.38 to 0.5 Gm.)

Unofficial Alkaloids and their Salts, with Allied Products—*Continued*

Geissospermine, $C_{19}H_{24}O_2N_2.H_2O$	From *Geissospermum læve.* It occurs in small white prisms, nearly insoluble in ether and water, and readily soluble in alcohol and dilute acids
Gelsemine, $C_{24}H_{28}O_4N_2$	From *Gelsemium sempervirens.* It occurs in an amorphous, white powder, of a very bitter taste and an alklaine reaction, slightly soluble in cold water. It is colored red, changing to purple when heated with sulphuric acid. *Gelsemine hydrochloride* has been given in doses of one-sixteenth of a grain (0.004 Gm.)
Glaucine	From *Glauceum luteum.* A white, crystalline powder
Glaucopicrine	From *Glauceum luteum.* A white, crystalline powder
Guaranine	From *Paullinia sorbilis.* Identical with caffeine
Hygrine	From the leaves of *Erythroxylon Coca.* A volatile alkaloid, of a pale yellow color and a burning taste
Hyoscine	Obtained from *Hyoscyamus niger* in the process for obtaining hyoscyamine, and also by boiling hyoscyamine with baryta water, when decomposition takes place, forming hyoscine and hyoscinic acid. Dose, one-sixty-fourth of a grain (0.001 Gm.)
Jervine, $C_{26}H_{37}O_3N + 2H_2O$	From *Veratrum album.* It occurs, when pure, as a white powder, tasteless, insoluble in water and ether, but soluble in alcohol and chloroform
Kairine, $C_{10}H_{13}ON.HCl + H_2O$	The hydrochloride of an artificial alkaloid prepared from chinoline. It occurs in commerce as a grayish or yellowish crystalline powder, having a slight phenol-like odor, and a saline, bitter, somewhat aromatic taste, soluble in boiling water. Dose, fifteen grains (1 Gm.)
Kairoline, Tetrahydromethylquinoline, or Tetrahydroethylquinoline	Antipyretic. The sulphates are the commercial salts
Laurotetanine	An alkaloid found in a number of plants belonging to the Laurinæ. A powerful poison, acting like strychnine
Lobeline	From *Lobelia inflata.* It is a volatile, yellow, somewhat aromatic liquid, having an acrid taste. Soluble in alcohol, ether, and fixed oils
Lupinine, $C_{10}H_{19}ON$	From different species of *Lupinus.* It occurs in colorless, rhombic prisms having a fruity odor and a very bitter taste
Lupuline	From *Humulus Lupulus.* A liquid alkaloid which has a strong coniine-like odor and an alkaline taste
Menispermine, $C_{18}H_{24}O_2N_2$	From *Cocculus Indicus*
Muscarine, $C_5H_{15}O_3N$	From *Amanita muscaria.* A colorless, crystalline powder, deliquescent, sparingly soluble in chloroform, and insoluble in ether
Nicotine, $C_{10}H_{14}N_2$	From *Nicotiana Tabacum.* A poisonous, oily liquid. It has an unpleasant tobacco-like odor, a burning taste, and a strongly alkaline reaction
Oxyacanthine, $C_{19}H_{21}O_3N$	From *Berberis vulgaris.* It is white, turning yellow on exposure to sunlight, having a bitter taste and an alkaline reaction. Soluble in 30 parts of boiling alcohol and in 1 part of cold alcohol, insoluble in water. Sulphuric acid colors it brown-red, turning to bright red on being heated
Parthenine	From *Parthenium Hysterophorus.* Used in doses of seven to ten grains (0.4 to 0.65 Gm.) in neuralgia
Pelósine	From *Chondodendron tomentosum.* It is amorphous, insoluble in water, slightly soluble in ether
Piturine, C_6H_8N	From the leaves of *Duboisia Hopwoodii.* A colorless liquid, of a nicotine odor and an acrid taste; on exposure to light it turns yellow and brown; freely soluble in water, alcohol, etc.
Quebrachine, $C_{21}H_{26}O_3N_2$	From the bark of *Aspidosperma Quebracho.* It yields crystallisable salts, and is colored yellow by sunlight
Quinidine Sulphate, $(C_{20}H_{24}O_2N_2)_2.H_2SO_4 + 2H_2O$	Obtained from the mother-liquors after the crystallisation of the quinine
Sanguinarine, $C_{20}H_{15}O_4N + H_2O$	From *Sanguinaria canadenis.* It occurs in white crystals having a bitter, acrid taste; soluble in ether and alcohol
Solanine	From *Dulcamara* and other plants. Dose, one grain (0.065 Gm.)
Sophorine	From the seeds of *Sophora speciosa.* A poisonous alkaloid
Staphisagrine, $C_{22}H_{33}O_5N$	From *Delphinium Staphisagria.* It is amorphous, very soluble in ether and in 200 parts of water
Thalline, Tetrahydroparaquinanisol, $C_9H_6H_4N(OCH_3)$	A hæmostatic. The sulphate and tartrate are powerful antipyretics. Dose, from four to eight grains (0.26 to 0.5 Gm.)
Theine	See Caffeine (page 1371)
Theobromine, $C_7H_8O_2N_4$	From *Theobroma Cacao.* It occurs in minute, colorless or white, bitter crystals, sparingly soluble in water, alcohol, and ether
Veratroidine, $C_{51}H_{78}O_{16}N_2$	From *Veratrum viride.* It is a white powder, of a bitter taste, soluble in alcohol, ether, chloroform, etc. It is colored yellow by sulphuric acid

QUESTIONS ON ALKALOIDS

What relation, with reference to their activity and value, do alkaloids hold toward other organic compounds? (See page 1311.)
What are alkaloids, chemically? Where are they found?
What one element is common to all? What is their action toward litmus paper?
How are they affected by acids? By alkalies?
Give other general characteristics and distinctive features.
Name several reagents which will precipitate most alkaloids.
What chemical classification is sometimes adopted for alkaloids?
According to the adopted nomenclature, what is the last syllable of the names of alkaloids? What of the names of neutral principles?
What is meant by alkaloidal assay?
Opium—What is opium? How and where is it obtained?
How much anhydrous morphine should opium in its normal moist condition yield when assayed by the official process? How is it officially described?
Describe, in detail, the process for assaying opium.
Powdered opium—What is the Latin name? Give the P. I. title.
Of what degree of fineness is powdered opium, and at what temperature should it be dried? How much anhydrous morphine should it contain?
How may powdered opium of higher percentage of morphine be brought to the proper strength?
Granulated opium—At what temperature should it be dried? What percentage of anhydrous morphine should it contain?
Deodorized opium—What kind of opium is directed to be used?
How is it prepared?
To what does opium owe its value?
How many alkaloids have been proved to exist in opium?
What acids are found combined with these alkaloids?
What other principles are also present?
Which of these alkaloids and their salts are official in the U. S. Pharmacopœia?
Mention the official preparations made from opium. From granulated opium. From powdered opium. From tincture of deodorized opium. From extract of opium.
Describe the more important requirements and regulations under the Harrison Act.
Morphine—What is the Latin official name?
Which was the first alkaloid discovered? When and by whom was it discovered?
Explain the objects and the steps in the process for preparing morphine.
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Moisture; meconic acid or meconates; foreign alkaloids; ammonium salts.
In what form is it usually used in medicine? Give the use and dose.
Morphine hydrochloride—What is the Latin title? What is its synonym?
How may it be prepared?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for impurities and dose.
Morphine sulphate—What is the Latin title?
How is it prepared?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the dose? What are the official preparations?
How strong was the solution formerly official?
What is the strength of Magendie's solution?
Codeine—Give the Latin name and synonym.
How may it be prepared?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the presence of morphine be detected? For what is it used medicinally?
Give the dose.
Codeine phosphate—What is the Latin title? How may it be prepared?
Give description, odor, taste, chemical reaction, solubility, tests for identity and test for sulphates and chlorides. What is the dose?
Codeine sulphate—What is the Latin title? How may it be prepared?
Give description, odor, taste, chemical reaction, solubility, and tests for identity.

What preparation is official? Give the dose.
Apomorphine hydrochloride—What is the synonym? How is it prepared?
Describe appearance, odor, taste, chemical reaction, and solubility. Give tests for identity and absence of impurities. For what is it used in medicine?
What is the expectorant dose? The emetic dose?
Ethylmorphine hydrochloride—What is the synonym? By what name is it commonly sold?
What is this substance and how is it prepared?
Describe its appearance, odor, reaction, and solubility. Give tests for identity and purity.
What are its uses and the dose?
Diacetylmorphine—What is its common name?
What is this substance? How is it prepared?
Describe the drug and give tests for identity and purity.
What are its uses and the dose?
What precautions must be taken in using this drug?
Diacetylmorphine hydrochloride—What is the synonym? How is it prepared? Describe its appearance and solubility. What are its uses and dose?
Cotarnine hydrochloride—What is this substance?
How is it prepared? Describe it and give solubility and tests for identity and purity.
What are its uses and the dose?
Cinchona—What is the Latin name? What are its synonyms?
What is its source? What percentage of cinchona alkaloids should be present?
How is it officially described?
Red cinchona—What is the Latin name? What is its synonym?
What percentage of cinchona alkaloids should it contain?
Upon what does the value of cinchona bark depend?
How may the value be ascertained?
Give the process of the U. S. Pharmacopœia for its assay.
How many alkaloids have been discovered in cinchona bark?
Have all of these been found in any one variety of bark?
Do they all exist naturally in the bark?
Which are the most important alkaloids?
What acids are found in cinchona bark? What other principles are found?
How are the artificial alkaloids chiefly produced?
Why is it difficult to preserve the galenical preparations of cinchona?
How may this difficulty be in a measure obviated?
What are the official preparations of cinchona and red cinchona?
Quinine—Give the Latin name.
How is it usually made?
Give description, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Organic impurities; morphine; ammonium salts; other cinchona alkaloids.
For what is it used? Give the dose.
Quinine sulphate—What is the Latin name? How may it be prepared?
How many quinine sulphates have been obtained?
Which of these are official in the U. S. Pharmacopœia?
What is the difference in chemical composition between quinine sulphate (U. S. Pharmacopœia) and quinine bisulphate?
What is the difference in chemical composition between quinine bisulphate and the acid sulphate?
Quinine sulphate—Give description, odor, taste, chemical reaction, solubility, and tests for identity.
How may the following impurities be detected?—Ammonium sulphate and inorganic salts; organic impurities; morphine. Describe in detail the test for the presence of other cinchona alkaloids. What are its uses?
What is the dose? How is it best given in the liquid form?
Quinine bisulphate—What is the Latin official name?
How is it made?
Give description, odor, taste, chemical reaction, and solubility. Give tests for identity and purity.
What advantage has this salt over the sulphate for use in medicine?
How much weaker is it than the sulphate?

Quinine hydrochloride—What is the Latin name? What is the synonym?
How may it be made?
Give description, odor, taste, chemical reaction, and solubility. Give tests for identity and purity. What are its uses?
Quinine hydrochloride—How is this salt prepared? Give solubility. What are its uses and advantages over other quinine salts?
Quinine hydrobromide—What is the Latin official name? What is the synonym?
How may it be made?
Give description, odor, taste, chemical reaction, and solubility. Give tests for identity and purity.
What are its uses and the dose?
Quinine salicylate—What is the official Latin title?
How may it be made? Give description, taste, chemical reaction, solubility and tests for identity and purity.
What is its especial advantage in medicine? Give the dose.
Quinine tannate—How is this salt prepared?
Describe its appearance, odor, taste, and solubility. Give tests for identity and purity.
What are its special advantages? What preparation is official?
Quinine and urea hydrochloride—How is this salt prepared? Describe its appearance, odor, taste, and solubility. What are its uses and the dose?
Quinine glycerophosphate—Give the synonym.
How is it prepared? What preparation is official?
Quinine hypophosphite—How is it prepared?
What preparation is official?
Quinine valerate—How is it prepared? What preparation is official?
Quinidine—What is this alkaloid and how prepared?
What is its solubility? What preparation is official?
What are its advantages?
Cinchonine sulphate—What is the Latin official name?
How is it obtained?
Give description, odor, taste, chemical reaction, and solubility. Give tests for identity and purity. What are its uses and the dose?
Cinchonidine sulphate—What is the Latin official name?
How is it obtained? Which barks contain most of it?
Give description, odor, taste, chemical reaction, and solubility. Give tests for identity and purity.
For what is it used medicinally? Give the dose.
Phenylcinchoninic acid—What is its synonym and common name?
How is it prepared? Describe its appearance, odor, taste, and solubility.
What are its uses and dose? What is "novatophan"?
Nux vomica—What is its definition? Give P. I. title.
What percentage of nux vomica alkaloids should it contain?
Describe the appearance and characteristics of nux vomica.
What alkaloids are present? What are their characteristics? What other substances does it contain?
Describe, in detail, the assay of nux vomica.
What is the dose? What are its official preparations?
Strychnine—Give the Latin name.
How may it be prepared?
Give description, odor, taste, chemical reaction, solubility, and tests for identity and purity.
Name the more important official preparations.
For what is it used medicinally? Give the dose.
Strychnine nitrate—Give the Latin name.
How may it be prepared?
Give description, odor, taste, chemical reaction, solubility, and tests for identity and purity.
What is the dose?
Strychnine sulphate—How is it prepared? Give description, taste, chemical reaction, and solubility.
Give the tests for identity.
Why is the sulphate more useful than the alkaloid? What is the dose?
Strychnine glycerophosphate—What is the synonym?

How may it be prepared? What is its solubility?
In what official preparation is it used?
Strychnine valerate—How is it prepared?
In what preparation is it used?
Solution of strychnine acetate—What is its synonym?
How is it prepared? What is its use? Give the dose.
Ergot—What are the synonyms?
What is ergot? Give its source.
Describe its appearance, odor, and taste. How should it be preserved?
What are its constituents? How may this drug be assayed? What occurs when the drug or its preparation is kept for an extended period?
What is ergotine? What are the uses of ergot and its dose?
Gelsemium—What are its synonyms? Give its definition and description. What does it contain?
What are its uses and the dose?
What are the official preparations?
Physostigma—What are its synonyms? What is its source? Give the official description. What does it contain?
Describe, in detail, the assay for physostigma.
What are its uses and the dose? What are its official preparations?
What are the physical properties of physostigmine?
Physostigmine salicylate—What is its synonym? How may it be made?
Give description, taste, chemical reaction, solubility, and tests for identity and purity.
What advantages does this salt possess over the alkaloid? For what is it used medicinally? What is the dose?
Belladonna leaves—What is the synonym and the P. I. title? What is the definition and description?
What percentage of belladonna alkaloid should be present?
Name its official preparations.
Belladonna root—What is the definition and description?
What percentage of belladonna alkaloids should be present?
To what does belladonna owe its activity?
Describe the assay process.
What is the medicinal use and dose? What are its official preparations?
Atropine—Give the Latin name.
How may it be prepared?
Give description, odor, taste, chemical reaction, and solubility. Give tests for identity and purity.
What is the N. F. preparation? What is the dose? Why is the sulphate preferred?
Atropine sulphate—How may it be prepared? What is the official definition? Give description, odor, taste, chemical reaction, and solubility.
Give tests for identity. What are its uses and the dose?
Homatropine hydrobromide—Give the Latin title and official definition. How may it be made?
Give description, odor, taste, chemical reaction, solubility, and tests for identity and purity.
For what is it used? Give the dose.
Scopolamine hydrobromide—What are its synonyms? How is it defined? What alkaloid is it chemically identical with? Describe its appearance and solubility. For what is it used medicinally? Give the dose.
Hyoscyamus—What is its synonym and P. I. title? What is its definition and description?
What does it contain? What is the dose? What are the official preparations?
Hyoscyamine hydrobromide—Give the official Latin title. How is it defined?
Give description, odor, taste, chemical reaction, solubility, and tests for identity and purity.
For what is it used in medicine? Give the dose.
Stramonium—What are the synonyms?
What is the official definition and description? How may it be assayed?
What do the leaves contain?
What is the dose? What are the official preparations?
Pilocarpus—What is its synonym? What is its source? What percentage of alkaloids should it contain? How is it described officially?

Give the marked differences between the two varieties of the drug. How may it be assayed?
What does it contain? Is it easily powdered? What are its uses and the dose? What is the official preparation?
Pilocarpine hydrochloride—Give the Latin name. How is it prepared?
Give description, odor, taste, chemical reaction, and solubility. Give tests, uses and dose.
Pilocarpine nitrate—Give the official Latin title. How may it be made?
Give description, odor, taste, chemical reaction, solubility, and tests for identity.
For what is it used medicinally? Give the dose.
Colchicum corm—What is the synonym?
What percentage of colchicine should it contain? What is its source? How is it officially described? What are its official preparations?
Colchicum seed—What is its source? What percentage of colchicine should it contain?
What does the corm contain in addition to colchicine? What do the seeds contain besides colchicine?
Why are the seeds so tough? How may they be exhausted of their active principle?
What are the official preparations? Give the uses and dose of colchicum corm and seed.
Colchicine—What is the Latin title? How may it be prepared?
Give description, odor, taste, chemical reaction, solubility, and test for identity and purity.
For what is it used medicinally? Give the dose.
Veratrum Viride—What is the Latin title? Give the synonyms.
Give the official definition and description. What additional drug was recognized in the U. S. P. VIII?
What does it contain? To what was it formerly supposed to owe its activity?
For what is it used medicinally?
What is the dose? What are the official preparations?
Veratrine—What is its source and how is it prepared?
What are its properties and uses? Describe appearance, odor, taste, chemical reaction, solubility, and tests for identity. What are its uses in medicine?
What are its official preparations?
Sanguinaria—What is its synonym? What is its definition and description?
What does it contain? What are its uses and the dose? What are its official preparations?
Staphisagria—What is its synonym? What is its source? Describe the drug.
What does it contain? What are good solvents? For what is it used? Name the official preparation. Give the dose.
Aconite—What is its source? What is the U. S. P. chemical standard? The U. S. P. biological standard? Why are both standards given?
What is the official definition and description? What does it contain?
How may aconitic acid be produced?
What are its properties and dose?
What are its official preparations?
Aconitine—What is the Latin title? How may it be prepared?
Give description, odor, taste, chemical reaction, solubility, and tests for identity and purity.
Should the alkaloid itself be tasted? What is the dose of the official aconitine? What is amorphous aconitine?
For what is aconitine used medicinally?
Hydrastis—What is its synonym? What is its definition? What percentage of hydrastis alkaloids should it contain? Describe the rhizome. How may it be assayed?
What does it contain?
What difference in appearance is there between the salts of hydrastine and those of berberine? What is its use and the dose? What are its official preparations?
Hydrastine—What is the Latin title? How may it be prepared?
Give description, taste, reaction, solubility, and tests for identity and purity.
What is its medicinal use and dose?
Hydrastine hydrochloride—What is the synonym?
How may it be prepared?

Give its solubility. What are its uses and dose?
Hydrastinine hydrochloride—What is the Latin title? Give the synonym. What is the official definition? How is this artificial alkaloid prepared?
Give description, odor, taste, chemical reaction, solubility, and tests for identity and purity.
For what is it used medicinally? Give the dose.
Compound solution of hydrastine—What is the synonym? How is it prepared?
Give uses and dose.
Pomegranate—What is the Latin official name? What is its source? Describe the stem bark; the root bark.
What does it contain? Which of the alkaloids is solid and crystallizable?
Which of the alkaloids are liquid? For what is it used in medicine? What is the dose?
Pelletierine tannate—What is the Latin title? How is it described?
How may it be prepared?
Give description, odor, taste, chemical reaction, solubility, and tests for identity.
For what is it used medicinally? Give the dose.
Ipecac—What is its source? Give the P. I. title. What percentage of ether-soluble alkaloid should it contain?
Describe Rio ipecac; Cartagena ipecac. How is it assayed? What does it contain?
What is its use and the dose? What are its official preparations?
How may the apothegmatic matter which is dissolved by hydro-alcoholic liquids be separated?
Emetine hydrochloride—How is it prepared? Describe this alkaloid. What are its solubilities?
Give its uses and dose.
Cocaine—What is the Latin title? How may it be prepared?
Give description, odor, solubility and tests for identity. What is its official preparation? For what is the alkaloidal cocaine preferred? What is its medicinal use? Give the dose.
Cocaine hydrochloride—What is the Latin title? How may it be prepared?
Give description, odor, reaction, solubility and tests for identity and purity. For what is it used medicinally? Give the dose. What restriction is placed upon the sale of this drug?
Betaeucaine hydrochloride—Give the synonyms. What is this substance? How is it prepared? What is its solubility? Give uses and dose.
Guarana—What is it? What is its source? What percentage of alkaloid should it contain? How is it officially described? How may it be assayed?
What does it contain?
What is its use and the dose?
What are its official preparations?
Caffeine—What is the Latin name? What is the synonym? What is its source?
How is it prepared?
Give description, odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the presence of organic impurities and alkaloids be detected?
What is its use and the dose? Name its official preparations.
Citrated caffeine—What is the Latin title? How may it be prepared? Is it a definite chemical salt?
Give description, odor, taste, chemical reaction, solubility and tests for tartaric acid, heavy metals, sulphuric acid. For what is it used? Give the dose.
Effervescent citrated caffeine—What is the Latin title? How is it prepared?
What is the dose?
Caffeine sodio-benzoate—What is this compound? How may it be prepared? Describe its appearance, odor, taste, reaction, and solubility. Give tests for identity and purity. What are its uses and the dose?
Caffeine sodio-salicylate—How may it be prepared? What are its uses and dose?
Theophylline—What is its synonym? What is this substance? How is it prepared? Describe it and give tests. What are its uses and the dose?
Theobromine sodio-salicylate—What is this substance?
What is theobromine? How may it be obtained?
How is theobromine sodio-salicylate prepared? What is its common name?
Describe the product and give tests. What are its uses and the dose?

Aspidosperma—Give the synonym. What is its source? What are its constituents? Describe the drug. What are its uses and dose?
Spigelia—What is the synonym? What is the official definition and description?
What does it contain? What is its medicinal use? Give the dose.
What preparation is official?
Sparteine sulphate—What is its source? How may it be prepared?
Give description, odor, taste, chemical reaction, solubility, and tests for identity and purity. Is this a liquid or solid alkaloid? For what is it used in medicine? Give the dose.
Lobelia—What is its synonym? What is its definition and description? What does it contain?
What is its use and dose? What are its official preparations?
Baptisia—Give the synonym. What is its source? Name its constituents. Describe the drug. What are its uses and dose?
Berberis—Give the synonym. Give the definition and description. What does it contain? Give its uses and the dose.
Cactus grandiflorus—What is the synonym? Give its definition and description.
How is this drug usually found in commerce?
What are its uses and the dose? What preparation is official?
Cocculus indicus—Give the synonym. How is it defined? What constituents are present? Describe the drug.
What are its uses? Name the official preparation.
Coffee—What is the Latin title? The synonym? How is it defined? What constituents are present? Describe the drug. What are its uses?
Conium—What is its synonym? Give definition and description. What is the N. F. standard? What constituents are present? What is peculiar about the alkaloid coniine? What are the uses of this drug?
Coptis—Give the synonym. How is it defined and described? Name the constituents. What are its uses and the dose?
Corydalis—What are the synonyms? Give its definition and description. What does it contain? What preparations are official? Give the uses and dose.
Larkspur seed—What is the Latin title?
Give the definition and description.
What are its constituents? What preparation is official? For what is it used?
Bittersweet—What is the Latin title?
Give the definition and description. What are its constituents? What preparation is official?
Give its uses and the dose.
Ignatia—Give the synonyms. What is this drug?
Give the N. F. standards. What constituents are present? How is it described?
What preparation is official? What are its medicinal uses and dose?
Kola—What is the synonym? How is it defined?
What is the N. F. standard? Name the constituents.
What preparation is official? Give the uses and dose.
Poppy capsules—What is the Latin title?
Name the constituents. How is it described?
What preparation is official? What are its uses and dose?
Pareira—Give the synonym. What is its source?
What constituents are present?
How is it described? Name its N. F. preparation.
Give the uses and dose.
Passion flower—What is the Latin title? The synonym?
Give definition and description. What constituents are present? What are its uses and dose?
Scoparius—What is the synonym? What is its source? What constituents are present? How is it described? Name its N. F. preparation.
What are its uses and the dose?
Solanum—What is the synonym? Give the definition and description. What constituents are present? Name the N. F. preparation.
What are its uses and dose?
Name the more important unofficial alkaloidal drugs and alkaloids.

CONDENSED CHART OF THE U. S. P. VEGE-

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Apocynaceæ Aspidosperma	A. Quebracho blanco	Quebracho	Dried bark	Argentine
Strophanthus	S. Kombe or S. hispidus	. . . .	Dried ripe seed	Tropical Africa
Aristolochiaceæ Serpentaria	Aristolochia S. and A. reticulata	Virginia Snakeroot	Rhizome and roots	United States
Berberidaceæ Podophyllum	P. peltatum	Mandrake, May-Apple Rhizome	Rhizome	North America
Betulaceæ Methylis Salicylas	Betula lenta	Oil of Wintergreen, Oil of Sweet Birch	Volatile oil	United States
Burseraceæ Myrrha	Commiphora M. and others	Gum Myrrh	Gum-resin	East Africa and Arabia
Caprifoliaceæ Viburnum Prunifolium	V. prunifolium, V. Lentago	Black Haw, Viburnum	Dried bark	United States
Chenopodiaceæ Oleum Chenopodii	C. Ambrosioides anthelminticum	Oil of American Wormseed	Volatile oil	. . . .
Saccharum	Beta vulgaris	Sucrose, Cane Sugar	. . . .	North America
Compositæ Arnica	A. montana	Arnica Flowers	Flower-heads	Mts. of Europe
Grindelia	G. camporum, G. cuneifolia and G. squarrosa	. . . .	Leaves and flowering tops	North America
Lactucarium	Lactuca virosa	. . . .	Dried milk-juice	C. and S. Europe
Matricaria	M. Chamomilla	German Chamomile	Flower-heads	Europe
Pyrethrum	Anacyclus P.	Pellitory Root	Root	Mediterranean basin
Taraxacum	T. Officinale	Dandelion	Rhizome and root	Europe, nat.

TABLE DRUGS, WITH THEIR PREPARATIONS

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Aspidosperma	Respiratory sedative; gr. lx (4 Gm.)	Aspidospermine, quebrachine	*U. S. Prep.*—Fluidextractum Aspidospermatis
Strophanthus	Sedative; gr. i (0.065 Gm.)	Strophanthin, kombic acid	*U. S. Prep.*—Tinctura Strophanthi
Serpentaria	Stimulant; gr. xv (1 Gm.)	Volatile oil	*U. S. Prep.*—Tinctura Cinchonæ Composita. *N. F. Prep.*—Fluidextractum Serpentariæ, Tinctura Serpentariæ
Podophyllum	Cathartic gr. viii (0.5 Gm.	Picropodophyllin Podophyllatoxin	*U. S. Prep.*—Fluidextractum Podophylli, Resina Podophylli. *N. F. Prep.*—Extractum Podophylli, Pilulæ Aloes et Podophylli Compositæ, Pilulæ Aloes, Hydrargyri et Podophylli, Pilulæ Aloini Compositæ, Pilulæ Catharticæ Vegetabiles, Pilulæ Colocynthidis et Podophylli, Pilulæ Laxativæ Post Partum
Methyl Salicylate	Flavoring agent, stimulant; ♏xv (1 mil)		*U. S. Prep.*—Emulsum Olei Morrhuæ, Fluidextractum Cascaræ Sagradæ Aromaticum, Syrupus Sarsaparillæ Compositus. *N. F. Prep.*—Cataplasma Kaolini, Inunctum Mentholis Compositum, Liquor Antisepticus, Liquor Antisepticus Alkalinus, Liquor Ferri Salicylatis, Liquor Pepsini Antisepticus, Nebula Aromatica, Nebula Mentholis Composita, Petroxolinum Methylis Salicylatis, Syrupus Sennæ Compositus, Trochisci Ulmi
Myrrh	Stimulant, vulnerary gr. viii (0.5 Gm.)	Volatile oil, resin, gum, bitter principle	*U. S. Prep.*—Pilulæ Rhei Compositæ, Tinctura Myrrhæ, Mistura Ferri Composita. *N. F. Prep.*—Pilulæ Aloes et Myrrhæ, Pilulæ Aloes, Hydrargyri et Scammonii Compositæ, Pilulæ Antiperiodicæ, Pilulæ Antiperiodicæ sine Aloe, Tinctura Aloes et Myrrhæ, Tinctura Antiperiodica, Tinctura Antiperiodicæ sine Aloe, Tinctura Capsici et Myrrhæ
Viburnum Prunifolium	Nervine and tonic; gr. xxx (2 Gm.)	Valeric acid, viburnin, tannin	*U. S. Prep.*—Extractum Viburni Prunifolii, Fluidextractum Viburni Prunifolii. *N. F. Prep.*—Elixir Viburni Prunifolii
Oil of Chenopodium	Anthelmintic; ♏iii (0.2 mil)	$C_{10}H_{16}-C_{10}H_{16}O$	
Sugar	. . . .	. . . .	(See page 1040)
Arnica	Vulnerary	Volatile oil, arnicin	*U. S. Prep.*—Tinctura Arnicæ. *N. F. Prep.*—Fluidextractum Arnicæ
Grindelia	Sedative; gr. xxx (2 Gm.)	Volatile oil, resin, bitter principle	*U. S. Prep.*—Fluidextractum Grindeliæ
Lactucarium	Sedative; gr. xv (1 Gm.)	Lactucin, lactucic acid, lactucerin	*U. S. Prep.*—Tinctura Lactucarii, Syrupus Lactucarii
Matricaria	Stimulant; ʒss (15 Gm.)	Volatile oil, anthemic acid	*N. F. Prep.*—Species Emollientes
Pyrethrum	Sialagogue; gr. xxx (2 Gm.)	Resin, fixed oil, pyrethrine, inulin	*U. S. Prep.*—Tinctura Pyrethri
Taraxacum	Cholagogue; ʒiiss (10 Gm.)	Taraxacin	*U. S. Prep.*—Extractum Taraxaci, Fluidextractum Taraxaci. *N. F. Prep.*—Elixir Gentianæ Glycerinatum, Elixir Taraxaci Compositum

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Convolvulaceæ Jalapa	Exogonium Purga	. . . . . .	Tuberous root	Eastern Mexico
Scammoniæ Radix	Convolvulus Scammonia	. . . . . .	Root	Western Asia
Cruciferæ Oleum Sinapis Volatile	Brassica nigra	Mustard Oil		. . . .
Sinapis Alba	Sinapis alba	Yellow Mustard	Seed	Asia and Southern Europe
Sinapis Nigra	Brassica nigra	Brown Mustard	Seed	Asia and Southern Europe
Cucurbitaceæ Colocynthis	Citrullus C.	Bitter Apple	Dried pulp	Southern and Western Asia
Elaterinum	Ecballium E.	. . . . . .	Principle from fruit juice	Southern Europe
Pepo	Cucurbita P.	Pumpkin Seed	Seed	Asia and America
Ericaceæ Methylis Salicylas (See page 1400)	Gaultheria procumbens	. . . . . .	. . . .	. . . .
Uva Ursi	Arctostaphylos Uva-ursi	Bearberry	Leaves	Northern Hemisphere
Euphorbiaceæ Oleum Ricini	Ricinus communis	. . . . . .	Fixed oil	India, United States
Oleum Tiglii	Croton Tiglium	. . . . . .	Fixed oil	India, cult.
Stillingia	S. sylvatica	Queen's Root	Root	Southern United States
Fagaceæ Creosotum	Usually Fagus silvatica, or F. ferruginea	. . . . . .	Product of dry distillation	. . . .
Galla	Quercus infectoria	Smyrna Galls	Excrescence	Levant
Gentianaceæ Gentiana	G. lutea	Yellow Gentian Root	Rhizome and roots	C. and S. Europe
Gigartinaceæ Chondrus	C. crispus or Gigartina mamillosa	Irish Moss, Carrageen	Dried plant	North Atlantic Coast

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Jalap	Hydragogue cathartic; gr. xv (1 Gm.)	Resin, starch, gum	*U. S. Prep.*—Pulvis Jalapæ Compositus, Resina Jalapæ. *N. F. Prep.*—Extractum Jalapæ, Fluidextractum Jalapæ, Pilulæ ad Prandium (Cole's), Pilulæ Catharticæ Vegetabiles, Pulvis Hydrargyri Chloridi Mitis et Jalapæ, Syrupus Sennæ Aromaticus, Tinctura Jalapæ, Tinctura Jalapæ Composita
Scammony Root	Hydragogue cathartic; gr. iv (0.25 Gm.)	Resin	*U. S. Prep.*—Resina Scammoniæ. Extractum Colocynthidis Compositum. *N. F. Prep.*—Pilulæ Aloes, Hydrargyri et Scammoniæ Composita, Pilulæ Colocynthidis Composita, Pilulæ Colocynthidis et Hyoscyami, Tinctura Jalapæ Composita
Volatile Oil of Mustard	Rubefacient; ♏ ⅛ (0.008 mil)	Allyl iso-thiocyanate	*N. F. Prep.*—Linimentum Sinapis Compositum, Spiritus Sinapis
White Mustard	Emetic; ʒiiss (10 Gm.)	Fixed oil, myrosin, sinalbin, mucilage	
Black Mustard	Emetic; ʒiiss (10 Gm.)	Fixed oil, myrosin, sinigrin, mucilage	
Colocynth	Hydragogue cathartic; gr. i (0.065 Gm.)	Colocynthin, colocynthitin, etc.	*U. S. Prep.*—Extractum Colocynthidis, Extractum Colocynthidis Compositum. *N. F. Prep.*—Pilulæ Antidyspepticæ, Pilulæ Catharticæ Vegetabiles, Pilulæ Colocynthidis Compositæ, Pilulæ Colocynthidis et Hyoscyami, Pilulæ Colocynthidis et Podophylli, Pilulæ Laxativæ Post Partum
Elaterin	Drastic cathartic; gr. 1/20 (0.003 Gm.)	. . . .	*U. S. Prep.*—Trituratio Elaterini
Pepo	Tænifuge; ℥i (30 Gm.)	Fixed oil, acrid resin, proteids, starch	
. . . .	. . . .	. . . .	. . . .
Uva Ursi	Diuretic, astringent; gr. xxx (2 Gm.)	Tannin, arbutin, gallic acid, ericolin, urson	*U. S. Prep.*—Fluidextractum Uvæ Ursi. *N. F. Prep.*—Elixir Buchu Compositum, Fluidextractum Buchu Compositum
Castor Oil	Purgative; ℥ss (15 mils)	Ricinolein and palmitin, ricin and ricinine	*U. S. Prep.*—Collodium Flexile. *N. F. Prep.*—Emulsum Olei Ricini, Oleum Ricini Aromaticum, Pilulæ Antimonii Compositæ
Croton Oil	Powerful purgative; ♏i (0.05 mil)	Croton-resin	*N. F. Prep.*—Collodium Tiglii, Linimentum Tiglii, Linimentum Tiglii Compositum, Pilulæ Aloes, Hydrargyri et Scammonii Compositæ
Stillingia	Alterative; gr. xxx (2 Gm.)	Resin, fixed oil, sylvacrol, starch	*U. S. Prep.*—Fluidextractum Stillingiæ. *N. F Prep.*—Elixir Corydalis Compositum, Fluidextractum Stillingiæ Compositum
Creosote	Bactericide; ♏iv (0.25 mil)	. . . .	*U.S. Prep.*—Aqua Creosoti. *N.F. Prep.*—Mulla Creosoti Salicylata, Petroxolinum Chloroformi Camphoratum
Nutgall	Astringent; gr. viii (0.5 Gm.)	Tannin, gallic acid, starch, resin	*U. S. Prep.*—Unguentum Gallæ. *N. F. Prep.*—Elixir Rubi Compositum, Tinctura Gallæ
Gentian	Tonic; gr. xv (1 Gm.)	Gentiopicrin, gentisic acid, gentianose, pectin	*U. S. Prep.*—Extractum Gentianæ, Fluidextractum Gentianæ, Tinctura Gentianæ Composita. *N. F. Prep.*—Elixir Gentianæ, Elixir Gentianæ et Ferri, Elixir Gentianæ et Ferri Phosphatis, Elixir Gentianæ Glycerinatum, Infusum Gentianæ Compositum, Pilulæ Antiperiodicæ, Pilulæ Antiperiodicæ sine Aloe, Pilulæ Ferri, Quininæ, Aloes et Nucis Vomicæ, Tinctura Amara, Tinctura Antiperiodica, Tinctura Antiperiodica sine Aloe, Tinctura Rhei et Gentianæ, Tinctura Zedoariæ Amara, Vinum Aurantii Compositum
Chondrus	Demulcent	Mucilaginous compounds, etc.	*N. F. Prep.*—Gelatinum Chondri, Mucilago Chondri

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Gramineæ Amylum	Zea Mays	Corn Starch	Grain	. . . .
Maltum	Hordeum sativum	. . . . . .	Grain partially germinated and then dried	Europe and North America
Saccharum	S. officinarum and other species of Sorghum	Sucrose, Cane Sugar	. . . .	Tropics
Triticum	Agropyron repens	Couch Grass, Dog Grass	Rhizome and roots	Europe, North America
Guttiferæ Cambogia	Garcinia Hanburii	Pipe Gamboge	Gum-resin	Anam and Siam
Hamamelidaceæ Styrax	Liquidambar orientalis	Liquid Storax	Balsam	Asia Minor
Hydrophyllaceæ Eriodictyon	E. californicum	Yerba Santa	Leaves	California and Northern Mexico
Hypocreaceæ Ergota	Claviceps purpurea, upon Secale cereale	Ergot of Rye, Spurred Rye	Sclerotium	Europe and United States
Labiatæ Mentha Piperita	M. piperita	. . . . . .	Leaves and flowering tops	Europe and North America
Mentha Viridis	M. spicata (M. viridis)	. . . . . .	Leaves and flowering tops	Europe and North America
Oleum Lavandulæ	Lavandula vera and others	. . . . . .	Volatile oil	. . . .
Oleum Menthæ Piperitæ	Mentha piperita	Peppermint Oil	Volatile oil	. . . .
Oleum Menthæ Viridis	M. spicata (M. viridis)	Spearmint Oil	Volatile oil	. . . .

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Starch	Absorbent	. . . .	*U. S. Prep.*—Extractum Aconiti, Extractum Belladonnæ Foliorum, Extractum Cascaræ Sagradæ, Extractum Cimicifugæ, Extractum Colchici Cormi, Extractum Colocynthidis, Extractum Fellis Bovis, Extractum Gelsemii, Extractum Hydrastis, Extractum Nucis Vomicæ, Extractum Opii, Extractum Physostigmatis, Extractum Rhei, Extractum Stramonii, Extractum Viburni Prunifolii, Glyceritum Amyli. *N. F. Prep.*—Extractum Aloes, Extractum Euonymi, Extractum Ignatiæ, Extractum Krameriæ, Extractum Leptandræ, Extractum Quassiæ, Pasta Resorcinolis Fortis, Pasta Resorcinolis Mitis, Pasta Zinci
Malt	Nutrient	Maltose, diastase	*U. S. Prep.*—Extractum Malti
Sugar	. . . .	. . . .	(See page 1040)
Triticum	Diuretic; ʒii (8 Gm.)	Glucose, triticin	*U. S. Prep.*—Fluidextractum Tritici
Gamboge	Hydragogue cathartic; gr. ii (0.13 Gm.)	Gum, resin, cambogic acid	*U. S. Prep.*—Pilulæ Catharticæ Compositæ
Storax	Expectorant; gr. xv (1 Gm.)	Benzoic acid, cinnamic acid, resins	*U. S. Prep.*—Tinctura Benzoini Composita
Eriodictyon	Expectorant; gr. xv (1 Gm.)	Resin, volatile oil	*U. S. Prep.*—Fluidextractum Eriodictyi. *N. F. Prep.*—Elixir Eriodictyi Aromaticum, Syrupus Eriodictyi Aromaticus
Ergot	Parturient; gr. xxx (2 Gm.)	Ergotinine, ergotoxine, parahydroxyphenylethamine, beta-iminazolylethylamine, etc.	*U. S. Prep.*—Extractum Ergotæ, Fluidextractum Ergotæ. *N. F. Prep.*—Extractum Ergotæ Aquosum, Tinctura Ergotæ Ammoniata
Peppermint	Stimulant; gr. lx (4 Gm.)	Volatile oil	*U. S. Prep.*—Spiritus Menthæ Piperitæ
Spearmint	Stimulant; gr. lx (4 Gm.)	Volatile oil	*U. S. Prep.*—Spiritus Menthæ Viridis
Oil of Lavender	Stimulant; ♏iii (0.2 mil)	$C_{10}H_{16}$ and esters	*U. S. Prep.*—Linimentum Saponis Mollis, Spiritus Ammoniæ Aromaticus, Spiritus Lavandulæ, Tinctura Lavandulæ Composita. *N. F. Prep.*—Acetum Aromaticum, Linimentum Ammonii Iodidi, Mistura Ferri Composita, Mistura Oleo-Balsamica, Oleum Hyoscyami Compositum, in all Petroxolins, Spiritus Odoratus
Oil of Peppermint	Stimulant; ♏iii (0.2 mil)	$C_{10}H_{18}O - C_{10}H_{20}O$	*U.S. Prep.*—Aqua Menthæ Piperitæ, Pilulæ Rhei Compositæ, Spiritus Menthæ Piperitæ. *N. F. Prep.*—Acetum Aromaticum, Cataplasma Kaolini, Elixir Catharticum Compositum, Gargarisma Guaiaci Compositum, Elixir Phosphori, Linimentum Opii Compositum, Liquor Antisepticus Alkalinus, Mistura Carminativa, Mistura Chloroformi et Morphinæ Composita, Mistura Olei Picis, Mistura Opii et Rhei Composita, Mistura Rhei Alkalina, Mistura Rhei Composita, Oleum Hyoscyami Compositum, Pilulæ Catharticæ Vegetabiles, Syrupus Ficorum Compositus, Trochisci Menthæ Piperitæ
Oil of Spearmint	Stimulant, ♏iii (0.2 mil)	$C_{10}H_{16}$—$C_{10}H_{14}O$	*U. S. Prep.*—Aqua Menthæ Viridis, Spiritus Menthæ Viridis

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Oleum Rosmarini	Rosmarinus officinalis	Rosemary Oil	Volatile oil	. . . .
Oleum Thymi	Thymus vulgaris	Thyme Oil	Volatile oil	. . . .
Thymol	Thymus vulgaris and others	. . . . . .	Phenol	Southern Europe, cult.
Lauraceæ				
Camphora	Cinnamomum C.	. . . . . .	Ketone	China and Japan
Cinnamomum Saigonicum	Cinnamomum, undetermined species	. . . . . .	Bark	China, cult.
Cinnamomum Zeylanicum	C. zeylanicum	. . . . . .	Inner bark	Ceylon
Oleum Cassiæ	Cinnamomum Cassia	Cassia Oil	Volatile oil	. . . .

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Oil of Rosemary	Stimulant; ♏iii (0.2 mil)	$C_{10}H_{16}$, borneol, $C_{10}H_{18}O$	*U. S. Prep.*—Linimentum Chloroformi, Linimentum Saponis, Tinctura Lavandulæ Composita. *N. F. Prep.*—Acetum Aromaticum, Linimentum Ammonii Iodidi, Linimentum Saponato-Camphoratum, Oleum Hyoscyami Compositum, Spiritus Odoratus
Oil of Thyme	Stimulant; ♏iii (0.2 mil)	Cymene, pinene, thymol	*N. F. Prep.*—Linimentum Saponato-Camphoratum, Liquor Antisepticus, Liquor Zinci et Alumini Compositus, Liquor Zinci et Ferri Compositus, Mistura Oleo-Balsamica, Oleum Hyoscyami Compositum
Thymol	Antiseptic; gr. ii–xv (0.13–1 Gm.)	$C_{10}H_{14}O$	(See page 1126)
Camphor	Stimulant; by mouth, gr. ii–x (0.13–0.65 Gm.); hypodermic, gr. ss–ii (0.032–0.13 Gm.)	$C_{10}H_{16}O$	*U. S. Prep.*—Aqua Camphoræ, Collodium Flexile, Linimentum Belladonnæ, Linimentum Chloroformi, Linimentum Camphoræ, Linimentum Saponis, Spiritus Camphoræ, Tinctura Opii Camphorata. *N. F. Prep.*—Ceratum Camphoræ, Ceratum Plumbi Subacetatis, Chloral Camphoratum, Emplastrum Fuscum Camphoratum, Linimentum Ammonii Iodidi, Linimentum Opii Compositum, Linimentum Saponato-Camphoratum, Linimentum Sinapis Compositum, Lotio Ammoniacalis Camphorata, Menthol Camphoratum, Mistura Camphoræ Acida, Mistura Camphoræ Aromatica, Mistura Opii et Chloroformi Composita, Mistura Opii et Rhei Composita, Nebula Aromaticum, Nebula Mentholis Composita, Petroxolinum Chloroformi Camphoratum, Petroxolinum Phenolis Camphoratum, Pilulæ Antiperiodicæ, Pilulæ Antiperiodicæ sine Aloe, Pilulæ Opii et Camphoræ, Tinctura Antiperiodica, Tinctura Antiperiodica sine Aloe, Tinctura Kino et Opii Composita, Tinctura Pectoralis, Unguentum Camphoræ
Saigon Cinnamon	Stomachic; gr. iv (0.25 Gm.)	Volatile oil, etc.	*U. S. Prep.*—Fluidextractum Aromaticum, Pulvis Aromaticus, Tinctura Cardamomi Composita, Tinctura Cinnamomi, Tinctura Gambir Composita, Tinctura Lavandulæ Composita, Tinctura Rhei Aromatica. *N. F. Prep.*—Cordiale Rubi Fructus, Elixir Rubi Compositum, Elixir Taraxaci Compositum, Mistura Rhei Alkalina, Pulvis Aromaticus Rubefaciens, Pulvis Cretæ Aromaticus, Pulvis Gambir Compositus, Pulvis Kino et Opii Compositus, Syrupus Cinnamomi, Syrupus Sennæ Aromaticus, Tinctura Antiperiodica, Tinctura Antiperiodica sine Aloe, Tinctura Aromatica, Tinctura Opii Crocata, Tinctura Pectoralis, Tinctura Viburni Opuli Composita, Tinctura Aurantii Composita
Ceylon Cinnamon	Stomachic; gr. iv (0.25 Gm.)	Volatile oil, etc.	
Oil of Cinnamon	Stimulant; ♏iii (0.2 mil)	Cinnamic aldehyde, C_9H_8O	*U. S. Prep.*—Acidum Sulphuricum Aromaticum, Aqua Cinnamomi, Fluidextractum Cascaræ Sagradæ Aromaticum, Infusum Digitalis, Mistura Cretæ, Spiritus Cinnamomi, Syrupus Rhei. *N. F. Prep.*—Acetum Aromaticum, Elixir Cardamomi Compositum, Elixir Glycyrrhizæ Aromaticum, Elixir Vanillini Compositum, Fluidglyceratum Cascaræ Sagradæ Aromaticum, Liquor Pepsini Aromaticus, Mistura Guaiaci, Mistura Oleo-Balsamica, Nebula Aromatica, Nebula Mentholis Composita, Oleum Ricini Aromaticum, Spiritus Cardamomi Compositus, Spiritus Vanillini Compositum, Syrupus Ipecacuanhæ et Opii, Syrupus Rhamni Catharticæ, Trochisci Gambir

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Oleum Sassafras	Sassafras variifolium	Sassafras Oil	Volatile oil	. . . .
Sassafras	S. variifolium	. . . . . .	Bark of root	North America
Leguminosæ Acacia	A. Senegal and others	Gum Arabic	Gummy exudation dried	Africa
Balsamum Peruvianum	Toluifera Pereiræ	Peru Balsam	Balsam	Central America
Balsamum Tolutanum	Toluifera Balsamum	Tolu Balsamum	Balsam	Venezuela
Chrysarobinum	Vouacapoua Araroba	. . . . . .	Principle from Goa powder	Brazil
Copaiba	One or more species of Copaiba	Balsam of Copaiba, Copaiva	Oleoresin	South America
Glycyrrhiza	G. glabra typica, G. glabra glandulifera	Liquorice Root, Licorice	Rhizome and roots	Europe and Asia
Kino	Pterocarpus Marsupium	. . . . . .	Inspissated juice	East Indies
Physostigma	P. venenosum	Calabar Bean, Ordeal Bean	Ripe seed	Western Africa
Santalum Rubrum	Pterocarpus santalinus	. . . . . .	Heart-wood	Madras, cult.

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Oil of Sassafras	Stimulant; ♏iii (0.2 mil)	Safrene, $C_{10}H_{16}$, safrol	*U. S. Prep.*—Syrupus Sarsaparillæ Compositus, Trochisci Cubebæ, Linimentum Tiglii Compositum. *N. F. Prep.*—Mistura Opii et Sassafras, Syrupus Eriodictyi, Syrupus Morphinæ et Acaciæ, Syrupus Pini Strobi Compositus, Syrupus Pini Strobi Compositus cum Morphina
Sassafras	Stimulant; ʒiiss (10 Gm.)	Arabic oil, tannin, sassafrid	*U. S. Prep.*—Fluidextractum Sarsaparillæ Compositum. *N. F. Prep.*—Decoctum Sarsaparillæ Compositum, Syrupus Pini Strobi Compositum, Syrupus Pini Strobi Compositus cum Morphina
Acacia	Demulcent	Arabic acid combined with calcium, magnesium, and potassium	*U. S. Prep.*—Emulsum Amygdalæ, Emulsum Olei Morrhuæ, Emulsum Olei Terebinthinæ, Mistura Cretæ, Mistura Glycyrrhizæ Composita, Mucilago Acaciæ, Pilulæ Ferri Iodidi, Pilulæ Phosphori, Pulvis Cretæ Compositus, Syrupus Acaciæ, Trochisci Cubebæ. *N. F. Prep.*—Emulsum Olei Morrhuæ cum Calcii Lactophosphate, Emulsum Olei Morrhuæ cum Calcii Phosphate, Emulsum Olei Morrhuæ cum Hypophosphitibus, Emulsum Olei Morrhuæ cum Pruno Virginiana, Emulsum Olei Ricini, Emulsum Petrolati, Mistura Copaibæ, Mistura Copaibæ et Opii, Syrupus Morphinæ et Acaciæ, Trochisci Phenolphthaleini
Balsam of Peru	Stimulant; gr. xv (1 Gm.)	Cinnamic and benzoic acids	*N. F. Prep.*—Mistura Oleo-Balsamica
Balsam of Tolu	Expectorant; gr. xv (1 Gm.)	Resins, cinnamic and benzoic acids	*U. S. Prep.*—Pilulæ Ferri Iodidi, Pilulæ Phosphori, Syrupus Tolutanus, Tinctura Benzoini Composita, Tinctura Tolutana
Chrysarobin	Cathartic; gr.ss. (0.03 Gm.)	. . . .	*U. S. Prep.*—Unguentum Chrysarobini
Copaiba	Stimulant; ♏xv (1 mil)	Volatile oil, resins, copaivic acid	*N. F. Prep.*—Massa Copaibæ, Mistura Copaibæ, Mistura Copaibæ et Opii
Glycyrrhiza	Expectorant; gr. xxx (2 Gm.)	Glycyrrhizin, acrid oleoresin, sugar	*U. S. Prep.*—Extractum Glycyrrhizæ, Extractum Glycyrrhizæ Purum, Fluidextractum Glycyrrhizæ, Fluidextractum Sarsaparillæ Compositum, Massa Hydrargyri, Mistura Glycyrrhizæ Composita, Pilulæ Ferri Iodidi, Pulvis Glycyrrhizæ Compositus, Syrupus Sarsaparillæ Compositus, Tinctura Aloes, Trochisci Ammonii Chloridi, Trochisci Cubebæ. *N. F. Prep.*—Decoctum Sarsaparillæ Compositum, Elixir Glycyrrhizæ Aquosum, Elixir Glycyrrhizæ Aromaticum, Elixir Taraxaci Compositum, Fluidglyceratum Cascaræ Sagradæ Aromaticum, Fluidglyceratum Glycyrrhizæ, Mistura Ammonii Chloridi, Mistura Olei Picis, Pilulæ ad Prandium (Hall's), Species Pectorales, Syrupus Cimicifugæ Compositus, Syrupus Glycyrrhizæ, Tinctura Aloes et Myrrhæ, Tinctura Rhei Dulcis
Kino	Astringent; gr. viii (0.5 Gm.)	Kinotannic acid, pyrocatechin	*U. S. Prep.*—Tinctura Kino. *N. F. Prep.*—Pulvis Gambir Compositus, Pulvis Kino et Opii Compositus, Tinctura Kino et Opii Composita
Physostigma	Sedative; gr. iss (0.1 Gm.)	Physostigmine, proteids	*U. S. Prep.*—Extractum Physostigmatis, Tinctura Physostigmatis
Red Saunders	Coloring agent	Santalic acid, santal	*U. S. Prep.*—Tinctura Lavandulæ Composita

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Senna	Cassia acutifolia and C. angustifolia	. . . . . .	Leaflets	Eastern and Central Africa
Tragacantha	Astragalus gummifer and others	Gum Tragacanth	Gummy exudation	Western Asia
Liliaceæ Aloe	A. vera, A. Perryi, A. ferox, and others	. . . . . .	Inspissated juice	Africa
Colchici Cormus	C. autumnale	Colchicum Root	Corm	Europe
Colchici Semen	C. autumnale	. . . . . .	Seed	Europe
Sarsaparilla	Smilax medica, S. ornata and S. officinalis	. . . . . .	Root	Tropical America
Scilla	Urginea maritima	. . . . . .	Fleshy inner scales of bulb	Mediterranean basin
Veratrum viride	V. viride	American Hellebore Green Hellebore	Rhisome and roots	North America
Linaceæ Linum	L. usitatissimum	Flaxseed	Ripe seed	Southern Europe, cult.
Oleum Lini	L. usitatissimum	Oil of Flaxseed Raw Linseed Oil	Fixed oil	Southern Europe, cult.
Lobeliaceæ Lobelia	L. inflata	Indian Tobacco	Dried leaves and flowering tops	Eastern United States and Canada

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Senna	Cathartic; gr. lx (4 Gm.)	Chrysophanic acid, anthraglucosennin, emodin	*U. S. Prep.*—Fluidextractum Sennæ, Infusum Sennæ Compositum, Pulvis Glycyrrhizæ Compositus, Syrupus Sarsaparillæ Compositus, Syrupus Sennæ. *N. F. Prep.*—Confectio Sennæ, Elixir Cascaræ Sagradæ Compositum, Elixir Catharticum Compositum, Species Laxativæ, Syrupus Ficorum Compositus, Syrupus Sennæ Aromaticus, Syrupus Sennæ Compositus
Tragacanth	Demulcent	Bassorin, starch	*U. S. Prep.*—Mucilago Tragacanthæ, Pilulæ Ferri Carbonatis, Trochisci Acidi Tannici, Trochisci Ammonii Chloridi, Trochisci Potassii Chloratis. *N. F. Prep.*—Emulsum Olei Morrhuæ cum Malto, Glyceritum Tragacanthæ, Stili Acidi Salicylici Dilubiles, Trochisci Carbonis Ligni, Trochisci Gambir, Trochisci Menthæ Piperitæ, Trochisci Quininæ Tannatis, Trochisci Santonini, Trochisci Santonini Compositi, Trochisci Sulphuris et Potassii Bitartratis, Trochisci Ulmi
Aloes	Cathartic: gr. iv (0.25 Gm.)	Aloin, emodin, little volatile oil	*U. S. Prep.*—Extractum Colocynthidis Compositus, Pilulæ Aloes, Pilulæ Rhei Compositæ, Tinctura Aloes, Tinctura Benzoini Composita. *N. F. Prep.*—Extractum Aloes, Pilulæ ad Prandium, Pilulæ Aloes et Asafœtidæ, Pilulæ Aloes et Ferri, Pilulæ Aloes et Mastiches, Pilulæ Aloes et Myrrhæ, Pilulæ Aloes et Podophylli Compositæ, Pilulæ Aloes Hydrargyri et Podophylli, Pilulæ Aloes, Hydrargyri et Scammonii Compositæ, Pilulæ Antiperiodicæ, Pilulæ Colocynthidis Compositæ, Pilulæ Colocynthidis et Hyoscyami, Pilulæ Ferri, Quininæ, Aloes, et Nucis Vomicæ, Pilulæ Laxativæ Post Partum, Pulvis Aloes et Canellæ, Tinctura Antiperiodica, Tinctura Zedoariæ Amara
Colchium Corm	Sedative, antirheumatic; gr.iv(0.25Gm.)	Colchicine, starch, resin	*U. S. Prep.*—Extractum Colchici Cormi. *N. F. Prep.*—Fluidextractum Colchici Cormi, Vinum Colchici Cormi
Colchicum Seed	Sedative; antirheumatic; gr. iii (0.2 Gm.)	Colchicine, fixed oil	*U. S. Prep.*—Fluidextractum Colchici Seminis, Tinctura Colchici Seminis. *N. F. Prep.*—Vinum Colchici Seminis
Sarsaparilla	Alterative; gr. xxx (2 Gm.)	Parillin, saponin, resin	*U. S. Prep.*—Fluidextractum Sarsaparillæ, Fluidextractum Sarsaparillæ Compositum, Syrupus Sarsaparillæ Compositus. *N. F. Prep.*—Decoctum Sarsaparillæ Compositum
Squill	Expectorant; diuretic; gr. iss (0.1 Gm.)	Scillipicrin, scillitoxin, scillin, sinistrin	*U. S. Prep.*—Acetum Scillæ, Fluidextractum Scillæ, Syrupus Scillæ, Syrupus Scillæ Compositus, Tinctura Scillæ. *N. F. Prep.*—Mistura Pectoralis, Stoke's, Oxymel Scillæ, Pilulæ Digitalis, Scillæ et Hydrargyri
Veratrum Viride	Cardiac sedative; gr. i (0.065 Gm.)	Jervine, resin, pseudojervine, rubijervine, protoveratrine, protoveratridine and veratramarin	*U. S. Prep.*—Fluidextractum Veratri Viridis, Tinctura Veratri Viridis
Linseed	Demulcent	Fixed oil, mucilage	*N. F. Prep.*—Species Emollientes
Linseed Oil	Laxative; f℥i (30 mils)	Linolin, palmitin, myristin	*U. S. Prep.*—Linimentum Calcis, Liquor Cresolis Compositus. *N. F. Prep.*—Ceratum Resinæ Compositum, Pasta Zinci Mollis, Petroxolinum Sulphuratum, Petroxolinum Sulphuratum Compositum
Lobelia	Expectorant, emetic; gr. iiss (0.15 Gm.)	Lobeline; inflatin	*U. S. Prep.*—Fluidextractum Lobeliæ, Tinctura Lobeliæ

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Loganiaceæ Gelsemium	G. sempervirens	Yellow Jasmine Root, Yellow Jessamine	Rhizome and roots	Southern United States
Nux Vomica	Strychnos Nux-vomica	. . . . . .	Seed	India
Spigelia	S. marilandica	Pinkroot	Rhizome and roots	United States
Lycopodiaceæ Lycopodium	L. clavatum	. . . . . .	Spores	Europe and North America
Magnoliaceæ Oleum Anisi	Illicium verum	Anise Oil	Volatile oil	Southwestern China
Malvaceæ Althæa	A. officinalis	Marshmallow Root	Root	Europe, nat.
Gossypium Purificatum	G. herbaceum and others	Absorbent Cotton	Hairs of seed	Tropics
Oleum Gossypii Seminis	G. herbaceum and others	Cotton Seed Oil	Fixed oil	. . . .
Menispermaceæ Calumba	Jateorhiza palmata	Columbo	Root	Eastern Africa
Moraceæ Cannabis	C. sativa or var. indica	Guaza, ganjah	Flowering tops of pistillate plants	Asia
Humulus	H. Lupulus	. . . . . .	Carefully dried strobiles	Europe and Asia
Myristicaceæ Myristica	M. fragrans	Nutmeg	Kernel of ripe seed	Molucca Islands
Oleum Myristicæ	Myristica fragrans	Oil of Nutmeg	Volatile oil	. . . .
Myrtaceæ Caryophyllus	Eugenia aromatica	Cloves	Dried flower buds	Molucca Islands
Eucalyptus	E. Globulus	Blue Gum Leaves	Leaves	Australia
Oleum Cajuputi	Melaleuca Leucadendron	Cajuput Oil	Volatile Oil	East Indian Islands

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Gelsemium	Antispasmodic; gr. ss (0.03 Gm.)	Gelsemine, volatile oil	*U. S. Prep.*—Extractum Gelsemii, Fluidextractum Gelsemii, Tinctura Gelsemii. *N. F. Prep.*—Elixir Sodii Salicylatis Compositum
Nux Vomica	Tonic; gr. i (0.065 Gm.)	Strychnine, brucine, proteids	*U. S. Prep.*—Extractum Nucis Vomicæ, Fluidextractum Nucis Vomicæ, Tinctura Nucis Vomicæ. *N. F. Prep.*—Elixir Phosphori et Nucis Vomicæ, Pilulæ Aloes et Podophylli Compositæ, Pilulæ Ferri, Quininæ, Aloes et Nucis Vomicæ, Pilulæ Laxativæ Post Partum
Spigelia	Anthelmintic; gr. lx (4 Gm.)	Volatile oil, bitter principle, spigelin	*U. S. Prep.*—Fluidextractum Spigeliæ
Lycopodium	Used externally	Fixed oil	
Oil of Anise Oil of Star, Anise	Carminative; ♏iii (0.2 mil)	$C_{10}H_{16}$, and anethol, $C_{10}H_{12}O$	*U. S. Prep.*—Aqua Anisi, Elixir Aromaticum, Fluidextractum Cascaræ Sagradæ Aromaticum, Spiritus Anisi, Spiritus Aurantii Compositus, Syrupus Sarsaparillæ Compositus, Tinctura Opii Camphorata. *N. F. Prep.*—Elixir Phosphori, Tinctura Pectoralis
Althæa	Demulcent	Asparagin, starch, mucilage	*U. S. Prep.*—Massa Hydrargyri, Pilulæ Ferri Carbonatis, Pilulæ Phosphori. *N. F. Prep.*—Species Pectorales, Syrupus Althææ
Purified Cotton	. . . .	Cellulose, fixed oil	*N. F. Prep.*—Gossypium Stypticum
Cottonseed Oil	Demulcent; f℥iv (15 mils)	Olein, palmitin	*U. S. Prep.*—Linimentum Camphoræ, Sapo Mollis, Unguentum Picis Compositum
Calumba	Tonic; gr. xxx (2 Gm.)	Columbin, berberine, mucilage	*U. S. Prep.*—Tinctura Calumbæ. *N. F. Prep.*—Fluidextractum Calumbæ
Cannabis	Nervine	Resin, cannabinine	*U. S. Prep.*—Extractum Cannabis, Fluidextractum Cannabis, Tinctura Cannabis. *N. F. Prep.*—Collodium Salicylici Compositum, Mistura Chlorali et Potassii Bromidi Composita, Mistura Chloroformi et Morphinæ Composita
Hops	Sedative; gr. xxx (2 Gm.)	Volatile oil, resin, lupulin	*N. F. Prep.*—Elixir Humuli, Fluidextractum Humuli, Tinctura Humuli
Myristica	Stimulant; gr. viii (0.5 Gm.)	Volatile oil, fixed oil, proteids	*U. S. Prep.*—Fluidextractum Aromaticum, Pulvis Aromaticus, Tinctura Lavandulæ Composita, Tinctura Rhei Aromatica, Trochisci Sodii Bicarbonatis. *N. F. Prep.*—Acetum Opii, Cordiale Rubi Fructus, Pulvis Cretæ Aromaticus, Pulvis Gambir Compositus, Syrupus Sennæ
Oil of Myristica	Stimulant; ♏iii (0.2 mil)	Pinene, $C_{10}H_{16}$, and myristicol, $C_{10}H_{16}O$	*U. S. Prep.*—Spiritus Ammonii Aromaticus. *N. F. Prep.*—Elixir Glycyrrhizæ Aromaticum, Elixir Pepsini et Rennini Compositum, Mistura Oleo-Balsamica
Clove	Aromatic; gr. iv (0.25 Gm.)	Volatile oil, tannin	*U. S. Prep.*—Tinctura Lavandulæ Composita, Tinctura Rhei Aromatica. *N. F. Prep.*—Cordiale Rubi Fructus, Elixir Rubi Compositum, Pulvis Aromaticus Rubefaciens, Pulvis Cretæ Aromaticus, Pulvis Myricæ Compositus, Syrupus Sennæ Aromaticus, Tinctura Aromatica, Tinctura Opii Crocata, Tinctura Viburni Opuli Composita
Eucalyptus	Febrifuge; gr. xxx (2 Gm.)	Volatile oil, tannin, resin	*U. S. Prep.*—Fluidextractum Eucalypti
Oil of Cajuput	Stimulant; ♏viii (0.5 mil)	Cajuputol, $C_{10}H_{18}O$	*N. F. Prep.*—Linimentum Tiglii

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Oleum Caryophylli	Eugenia aromatica and Jambosa Caryophyllus	Clove Oil, Oil of Cloves	Volatile oil	. . . .
Oleum Eucalypti	Eucalyptus Globulus	Eucalyptus Oil	Volatile oil	. . . .
Oleum Pimentæ	Pimenta officinalis	Oil of Allspice, Pimento Oil	Volatile oil	. . . .
Oleaceæ Manna	Fraxinus Ornus	. . . . . .	Concrete saccharine exudation	Mediterranean basin
Oleum Olivæ	Olea europæa	. . . . . .	Fixed oil	Southern Europe
Palmæ Sabal	Serenoa serrulata	Saw Palmetto Berries	Partially dried ripe fruit	North America
Papaveraceæ Opii Pulvis	. . . .	. . . . . .	Powder	. . . .
Opium	Papaver somniferum	. . . . . .	Air-dried milky exudation	Western Asia, cult.
Opium Deodoratum	. . . .	. . . . . .	Powder	. . . .
Opium Granulatum	. . . .	. . . . . .	Coarse powder	. . . .
Sanguinaria	S. canadensis	Blood Root	Rhizome and roots	North America
Pedaliaceæ Oleum Sesami	Sesamum indicum	Teel Oil, Benne Oil	Fixed oil	Southern Europe and Asia
Pinaceæ Oleum Cadinum	Juniperus oxycedrus	Cade Oil, Oil of Juniper Tar	Product of dry distillation	. . . .
Oleum Juniperi	Juniperus Communis	Juniper Oil, Oil of Juniper Berries	Volatile oil	. . . .

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Oil of Clove	Stimulant; ♏iii (0.2 mil)	$C_{10}H_{16}$, and eugenol, $C_{10}H_{12}O_2$	*N. F. Prep.*—Acetum Aromaticum, Elixir Cardamomi Compositum, Elixir Glycyrrhizæ Aromaticum, Fluidglyceratum Cascaræ Sagradæ Aromaticum, Liquor Pepsini Aromaticus, Nebula Aromatica, Oleum Ricini Aromaticum, Pilulæ Colocynthidis Compositæ, Pilulæ Colocynthidis et Hyoscyami, Spiritus Cardamomi Compositus, Syrupus Eriodictyi Aromaticus, Tinctura Kino et Opii Composita
Oil of Eucalyptus	Stimulant; ♏viii (0.5 mil)	$C_{10}H_{18}$, $C_{10}H_{18}O$	
Oil of Pimenta	Stimulant; ♏iii (0.2 mil)	$C_{10}H_{16}$, and eugenol, $C_{10}H_{12}O_2$	*N. F. Prep.*—Liquor Pepsini Aromaticus, Spiritus Myrciæ Compositus
Manna	Laxative; ʒss (15 Gm.)	Mannite, resin, glucose	*U. S. Prep.*—Infusum Sennæ Compositum. *N. F. Prep.*—Syrupus Mannæ
Olive Oil	Laxative; f℥i (30 mil)	Olein, palmitin, stearin	*U. S. Prep.*—Emplastrum Plumbi. *N. F. Prep.*—Emplastrum Fuscum Camphoratum, Linimentum Tiglii Compositum, Oleatum Aconitinæ, Oleatum Atropinæ, Oleatum Cocainæ, Oleatum Veratrinæ, Oleum Phenolatum, Unguentum Fuscum
Sabal	Diuretic, tonic; gr. xv (1 Gm.)	Volatile oil, fixed oil, an alkaloid, resin	*U. S. Prep.*—Fluidextractum Sabal. *N. F. Prep.*—Tinctura Sabal et Santali
Powdered Opium	Narcotic; gr. i (0.065 Gm.)	Morphine, narcotine, codeine, etc.	*U. S. Prep.*—Opium Deodoratum, Pulvis Ipecacuanhæ et Opii, Tinctura Opii Camphorata. *N. F. Prep.*—Pilulæ Opii et Camphoræ, Pilulæ Opii et Plumbi, Pulvis Cretæ et Opii Aromaticus, Pulvis Kino et Opii Compositus
Opium	Narcotic; gr. iss (0.1 Gm.)	Morphine, narcotine, codeine	*U. S. Prep.*—Extractum Opii, Mistura Glycyrrhizæ Composita, Opii Pulvis, Opium Deodoratum, Opium Granulatum, Pulvis Ipecacuanhæ et Opii, Tinctura Opii, Tinctura Opii Camphorata, Tinctura Opii Deodorata. *N. F. Prep.*—Acetum Opii, Linimentum Opii Compositum, Lotio Plumbi et Opii, Mistura Camphoræ Acida, Mistura Carminativa, Mistura Copaibæ et Opii, Mistura Magnesiæ, Asafœtidæ et Opii, Mistura Opii et Chloroformi Composita, Mistura Opii et Rhei Composita, Mistura Opii et Sassafras, Mistura Pectoralis (Stoke's), Pilulæ Opii et Camphoræ, Pilulæ Opii et Plumbi, Pulvis Cretæ et Opii Aromaticus, Pulvis Kino et Opii Compositus, Syrupus Ipecacuanhæ et Opii, Tinctura Ipecacuanhæ et Opii, Tinctura Kino et Opii Composita, Tinctura Opii Crocata, Tinctura Pectoralis
Deodorized Opium	Narcotic; gr. i (0.065 Gm.)	Morphine, narcotine, codeine	
Granulated Opium	Narcotic; gr. i (0.065 Gm.)	Morphine, narcotine, codeine	*U. S. Prep.*—Tinctura Opii, Tinctura Opii Deodorati. *N. F. Prep.*—Acetum Opii, Tinctura Opii Crocata
Sanguinaria	Alterative; gr. ii (0.13 Gm.)	Sanguinarine, chelerythrine, resins, starch, fumarine, homochelidonine	*U. S. Prep.*—Tinctura Sanguinariæ. *N. F. Prep.*—Fluidextractum Sanguinariæ, Syrupus Pini Strobi Compositus, Syrupus Pini Strobi Compositus cum Morphinæ, Syrupus Sanguinariæ
Sesame Oil	Demulcent	Olein, stearin	*U. S. Prep.*—Linimentum Ammoniæ. *N. F. Prep.*—Olea Infusa
Oil of Cade	Alterative, Antiparasitic	Empyreumatic products	*N. F. Prep.*—Linimentum Saponis Mollis Compositum, Petroxolinum Cadini, Petroxolinum Sulphuratum Compositum, Unguentum Sulphuris Compositum
Oil of Juniper	Stimulant, diuretic; ♏iii (0.2 mil)	. . . .	*U. S. Prep.*—Spiritus Juniperi, Spiritus Juniperi Compositus. *N. F. Prep.*—Acetum Aromaticum

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Oleum Pini Pumilionis	Pinus montana	Dwarf Pine Oil	Volatile oil	Northwestern United States
Oleum Terebinthinæ	Pinus palustris and others	Turpentine Oil, "Spirits of Turpentine"	Volatile oil	. . . .
Pix Liquida	Pinus palustris and others	Pine Tar	Product of destructive distillation	United States
Resina	Pinus palustris and others	Colophony	Residue (from distilling turpentine)	United States
Piperaceæ Cubeba	Piper C.	Cubebs	Unripe, but full grown fruit	Java, cult.
Oleum Cubebæ	Piper Cubeba	Cubeb Oil	Volatile oil	. . . .
Piper	P. nigrum	Black Pepper	Unripe fruit	India, cult.
Polygalaceæ Senega	Polygala S.	Senega, Snake-	Root	United States
Polygonaceæ Rheum	R. officinale, R. palmatum, and var. tanguticum or others	. . . . . .	Rhizome	Western and Central China and Thibet
Polypodiaceæ Aspidium	Dryopertis Filix-mas, Dryopteris marginalis	Male Fern	Rhizome and stipes	Europe, Asia and North America
Punicaceæ Granatum	Punica G.	Pomegranate Bark	Bark of stem and root	Warm Climates
Ranunculaceæ Aconitum	A. Napellus	Monkshood	Tuberous root	Europe and Asia

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Oil of Dwarf Pine Needles	Expectorant	L-pinene, l-phellandrene, etc.	
Oil of Turpentine	Stimulant	$C_{10}H_{16}$	*U. S. Prep.*—Ceratum Cantharidis, Linimentum Terebinthinæ, Oleum Terebinthinæ Rectificatum. *N. F. Prep.*—Linimentum Opii Compositum, Linimentum Terebinthinæ Aceticum, Linimentum Tiglii Compositum, Petroxolinum Sulphuratum Compositum
Tar	Expectorant; gr. viii (0.5 Gm.)	(See page 985)	*U. S. Prep.*—Syrupus Picis Liquidæ. *N. F. Prep.*—Unguentum Picis Liquidæ, Glyceritum Picis Liquidæ, Liquor Picis Alkalinus, Vinum Picis
Rosin	Mild stimulant	Abietic anhydride	*U. S. Prep.*—Ceratum Cantharidis, Ceratum Resinæ, Emplastrum Resinæ, Linimentum Terebinthinæ
Cubeb	Stimulant; gr. xv (1 Gm.)	Volatile oil, resin, cubebin, cubebic acid	*U. S. Prep.*—Oleoresina Cubebæ. *N. F. Prep.*—Elixir Buchu Compositum, Fluidextractum Buchu Compositum, Fluidextractum Cubebæ, Pilulæ Antiperiodicæ, Pilulæ Antiperiodicæ sine Aloe, Tinctura Antiperiodica, Tinctura Antiperiodica sine Aloe, Tinctura Cubebæ
Oil of Cubeb	Stimulant; ♏viii (0.5 mil)	$C_{10}H_{16}-C_{15}H_{26}O$	
Pepper	Stimulant; gr. viii (0.5 Gm.)	Volatile oil, resin, piperine, fat	*U. S. Prep.*—Oleoresina Piperis. *N. F. Prep.*—Tinctura Antiperiodica, Tinctura Antiperiodica sine Aloe
Senega	Expectorant; gr. xv (1 Gm.)	Polygalic acid, saponin, pectin, fixed oil	*U. S. Prep.*—Fluidextractum Senegæ, Syrupus Senegæ, Syrupus Scillæ Compositus. *N. F. Prep.*—Mistura Pectoralis (Stoke's), Syrupus Cimicifugæ Compositus
Rhubarb	Cathartic, astringent; gr. xv (1 Gm.)	Chrysophanic acid, emodin, rhein, tannin and resins	*U. S. Prep.*—Extractum Rhei, Fluidextractum Rhei, Pilulæ Rhei Compositæ, Pulvis Rhei Compositus, Syrupus Rhei, Syrupus Rhei Aromaticus, Tinctura Rhei, Tinctura Rhei Aromatica. *N. F. Prep.*—Elixir Catharticum Compositum, Fluidglyceratum Rhei, Mistura Opii et Rhei Composita, Mistura Rhei Alkalina, Mistura Rhei Composita, Pilulæ Antiperiodicæ, Pilulæ Antiperiodicæ Sine Aloe, Pilulæ Rhei, Pulvis Rhei et Magnesiæ Anisatus, Syrupus Sennæ Aromaticus, Syrupus Sennæ Compositus, Tinctura Antiperiodica, Tinctura Antiperiodica sine Aloe, Tinctura Rhei Aquosa, Tinctura Rhei Dulcis, Tinctura Rhei et Gentianæ, Tinctura Zedoariæ Amara, Vinum Rhei Compositum
Aspidium	Tænifuge; gr. lx (4 Gm.)	Filicic acid; volatile oil, filixtannic acid	*U. S. Prep.*—Oleoresina Aspidii
Pomegranate	Anthelmintic; gr. xxx (2 Gm.)	Pelletierine, tannin, isopelletierine, methylpelletierine, pseudopelletierine	*U. S. Prep.*—Fluidextractum Granati
Aconite	Sedative; gr. ½ (0.03 Gm.)	Resin, aconitic acid, aconitine	*U. S. Prep.*—Extractum Aconiti, Fluidextractum Aconiti, Tinctura Aconiti. *N. F. Prep.*—Linimentum Aconiti et Chloroformi

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Cimicifuga	C. racemosa	Black Cohosh, Black Snakeroot Macrotys	Rhizome and roots	North America
Hydrastis	H. canadensis	Golden Seal	Rhizome and roots	North America
Staphisagria	Delphinium S.	Stavesacre	Ripe seed	Europe
Rhamnaceæ Frangula	Rhamnus F.	Buckthorn Bark	Bark	Western Asia, cult.
Cascara Sagrada	Rhamnus Purshiana	Rhamnus Purshiana	Bark	Western United States
Rhodophyceæ Agar	Gracilaria lichenoides and others	Agar-agar	Dried mucilaginous substance	Eastern coast of Asia
Rosaceæ Amygdala Dulcis	Prunus Amygdalus dulcis	. . . . . .	Seed	Western Asia, cult.
Oleum Amygdalæ Amaræ	Prunus Amygdalus amara	Bitter Almond Oil	Volatile oil	. . . .
Oleum Amygdalæ Expressum	Prunus Amygdalus	Oil of Sweet Almond	Fixed oil	. . . .
Prunus Virginiana	P. serotina (P. virginiana)	Wild Black Cherry Bark	Stem-bark	North America
Rosa Gallica	R. gallica	. . . . . .	Petals	Southern Europe, cult.
Rubiaceæ Cinchona	C. Ledgeriana, C. Calisaya, and others	Yellow Peruvian Bark Calisaya Bark	Bark	South America, cult.
Cinchona Rubra	C. succirubra	Red Peruvian Bark	Bark	South America, cult.
Gambir	Ourouparia G.	Pale Catechu	Extract from leaves and twigs	India
Ipecacuanha	Cephaëlis I. and Cephaëlis acuminata	. . . . . .	Root	Brazil

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Cimicifuga	Alterative; gr. xv (1 Gm.)	Crystalline principle, resin, tannin	*U. S. Prep.*—Extractum Cimicifugæ, Fluidextractum Cimicifugæ. *N. F. Prep.*—Elixir Sodii Salicylatis Compositum; Syrupus Cimicifugæ Compositus, Tinctura Cimicifugæ
Hydrastis	Alterative, tonic; gr. xxx (2 Gm.)	Berberine, hydrastine, canadine	*U. S. Prep.*—Extractum Hydrastis, Fluidextractum Hydrastis, Glyceritum Hydrastis, Tinctura Hydrastis. *N. F. Prep.*—Mistura Rhei Alkalina
Staphisagria	Used externally	Delphinine, fixed oil, staphisagrine, staphisagroine and calcitrapine	*U. S. Prep.*—Fluidextractum Staphisagriæ
Frangula	Laxative; gr. xv (1 Gm.)	Frangulin, emodin, frangulic acid	*U.S.Prep.*—Fluidextractum Frangulæ. *N. F. Prep.*—Elixir Catharticum Compositum, Syrupus Sennæ Compositus
Cascara Sagrada	Laxative; gr. xv (1 Gm.)	Purgative resins, chrysophanic acid	*U. S. Prep.*—Extractum Cascaræ Sagradæ, Fluidextractum Cascaræ Sagradæ, Fluidextractum Cascaræ Sagradæ Aromaticum. *N. F. Prep.*—Elixir Cascaræ Sagradæ, Elixir Cascaræ Sagradæ Compositum, Fluidglyceratum Cascaræ Sagradæ, Fluidglyceratum Cascaræ Sagradæ Aromaticum, Pilulæ Aloini, Strychninæ et Belladonnæ Compositæ, Syrupus Ficorum Compositus
Agar	Nutrient; ʒiiss (10 Gm.)	Mucilage	
Sweet Almond	Demulcent	Fixed oil, proteids	*U. S. Prep.*—Emulsum Amygdalæ
Oil of Bitter Almond	Sedative; ♏ss (0.03 mil)	Benzaldehyde, C_7H_6O	*U. S. Prep.*—Aqua Amygdalæ Amaræ, Spiritus Amygdalæ Amaræ. *N. F. Prep.*—Elixir Amygdalæ Compositum, Elixir Anisi
Expressed Oil of Almond	Laxative; f℥i (30 mils)	Olein, palmitin	*U. S. Prep.*—Emulsum Olei Terebinthinæ, Unguentum Aquæ Rosæ. *N. F. Prep.*—Emulsum Petrolati, Oleum Phosphoratum, Unguentum Veratrinæ
Wild Cherry	Sedative; gr. xxx (2 Gm.)	Tannin, amygdalin, emulsin	*U. S. Prep.*—Syrupus Pruni Virginianæ. *N. F. Prep.*—Elixir Taraxaci Compositum, Emulsum Olei Morrhuæ cum Pruno Virginiana, Fluidextractum Pruni Virginianæ, Infusum Pruni Virginianæ, Syrupus Cimicifugæ Compositus, Syrupus Pini Strobi Compositus, Syrupus Pini Strobi Compositus cum Morphina, Vinum Pruni Virginianæ, Vinum Pruni Virginianæ Ferratum
Red Rose	Tonic	Quercitrin	*U. S. Prep.*—Fluidextractum Rosæ. *N.F. Prep.*—Confectio Rosæ, Infusum Rosæ Compositum, Pilulæ Aloes et Mastiches, Syrupus Rosæ
Cinchona	Tonic, antiperiodic; gr. xv (1 Gm.)	Quinine, quinidine, cinchonine, cinchonidine, etc.	*U.S.Prep.*—Fluidextractum Cinchonæ, Tinctura Cinchonæ. *N. F. Prep.*—Extractum Cinchonæ, Infusum Cinchonæ
Red Cinchona	Tonic, antiperiodic; gr. xv (1 Gm.)	(See Cinchona)	*U. S. Prep.*—Tinctura Cinchonæ Composita. *N. F. Prep.*—Fluidextractum Cinchonæ Aquosum, Gargarisma Guaiaci Compositum
Gambir	Astringent; gr. xv (1 Gm.)	Catechutannic acid, catechin	*U. S. Prep.*—Tinctura Gambir Composita. *N. F. Prep.*—Pulvis Gambir Compositus, Tinctura Pectoralis, Trochisci Gambir
Ipecac	Expectorant, gr. i (0.065 Gm.); Emetic, gr. xv (1 Gm.)	Emetine, cephaëline, ipecacuanhic acid, pectin, psychotrine	*U. S. Prep.*—Fluidextractum Ipecacuanhæ, Pulvis Ipecacuanhæ et Opii, Syrupus Ipecacuanhæ. *N. F. Prep.*—Mistura Rhei Composita, Pilulæ ad Prandium, Pilulæ Antidyspepticæ, Pilulæ Laxativæ Compositæ, Pilulæ Laxativæ Post Partum, Syrupus Asari Compositus, Syrupus Cimicifugæ Compositus, Syrupus Ipecacuanhæ et Opii, Tinctura Ipecacuanhæ et Opii, Vinum Ipecacuanhæ

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Rutaceæ Aurantii Amari Cortex	Citrus Aurantium amara	. . . . . .	Dried rind of fruit	Northern India, and cult.
Aurantii Dulcis Cortex	Citrus Aurantium sinensis	. . . . . .	Fresh outer rind of ripe fruit	Northern India, and cult.
Oleum Aurantii	Citrus Aurantium sinensis	Oil Sweet Orange, Orange Oil	Volatile oil	. . . .
Limonis Cortex	Citrus medica Limonum	. . . . . .	Fresh outer rind of ripe fruit	Northern India, and cult.
Oleum Limonis	Citrus medica Limonum	Lemon Oil	Volatile oil	. . . .
Buchu	Barosma betulina and Barosma serratifolia	. . . . . .	Leaves	Southern Africa
Pilocarpus	P. Jaborandi or P. microphyllus	Jaborandi	Leaflets	Brazil
Xanthoxylum	X. americanum and Clava-Herculis	Prickly Ash Bark	Bark	North America
Santalaceæ Oleum Santali	Santalum album	Oil of Sandalwood	Volatile oil	. . . .
Sapindaceæ Guarana	Paullinia Cupana	. . . . . .	Dried paste from crushed seeds	Northern and Western Brazil
Scrophulariaceæ Digitalis	D. purpurea	Foxglove	Leaves	Europe
Simarubaceæ Quassia	Picrasma excelsa, or Quassia amara	Bitter Wood	Wood	Jamaica
Solanaceæ Belladonnæ Folia	Atropa B.	Deadly Nightshade Leaves	Leaves	Central and Southern Europe
Belladonnæ Radix	Atropa B.	Deadly Nightshade Root	Root	Central and Southern Europe
Capsicum	C. frutescens	Cayenne Pepper African Chillies	Dried, ripe fruit	Tropical America

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Bitter Orange Peel	Stimulant, tonic; gr. xv (1 Gm.)	Volatile oil, hesperidin, etc.	*U. S. Prep.*—Fluidextractum Aurantii Amari, Tinctura Aurantii Amari, Tinctura Cinchonæ Composita, Tinctura Gentianæ Composita. *N. F. Prep.*—Infusum Gentianæ Compositum, Tinctura Amara, Vinum Aurantii Compositum, Vinum Rhei Compositum
Sweet Orange Peel	Flavoring	Volatile oil	*U. S. Prep.*—Tinctura Aurantii Dulcis
Oil of Orange	Flavoring	$C_{10}H_{16}$	*U. S. Prep.*—Elixir Aromaticum, Spiritus Aurantii Compositus. *N. F. Prep.*—Elixir Cardamomi Compositum, Elixir Ferri Pyrophosphatis, Quininæ et Strychninæ, Elixir Vanillini Compositum, Liquor Ferri Peptonati, Liquor Ferri Peptonati et Mangani, Spiritus Cardamomi Compositus, Spiritus Myrciæ Compositus, Spiritus Vanillini Compositus, Syrupus Quinidinæ, Trochisci Sulphuris et Potassii Bitartratis
Lemon Peel	Flavoring	Volatile oil, hesperidin	*U. S. Prep.*—Tinctura Limonis Corticis
Oil of Lemon	Flavoring	Pinene, limonene, etc.	*U. S. Prep.*—Elixir Aromaticum, Liquor Magnesii Citratis, Spiritus Ammoniæ Aromaticus, Spiritus Aurantii Compositus. *N. F. Prep.*—Acetum Aromaticum, Linimentum Terebinthinæ Aceticum, Mistura Oleo-Balsamica, Spiritus Odoratus, Syrupus Eriodictyi Aromaticus, Syrupus Sennæ Aromaticus
Buchu	Diuretic; gr. xxx (2 Gm.)	Volatile oil, diosphenol, resin, mucilage	*U. S. Prep.*—Fluidextractum Buchu. *N. F. Prep.*—Elixir Buchu, Elixir Buchu Compositum, Elixir Buchu et Potassii Acetatis, Fluidextractum Buchu Compositum
Pilocarpus	Sialagogue; gr. xxx (2 Gm.)	Volatile oil, pilocarpine, isopilocarpine	*U. S. Prep.*—Fluidextractum Pilocarpi
Xanthoxylum	Alterative; gr. xxx (2 Gm.)	Acrid green oil, resin	*U. S. Prep.*—Fluidextractum Xanthoxyli. *N. F. Prep.*—Elixir Corydalis Compositum
Oil of Santal	Stimulant; ♏viii (0.5 mil)	Santalol, $C_{15}H_{26}O$	
Guarana	Stimulant; gr xxx (2 Gm.)	Caffeine, saponin	*U. S. Prep.*—Fluidextractum Guaranæ. *N. F. Prep.*—Elixir Guaranæ
Digitalis	Cardiac stimulant; gr. i (0.065 Gm.)	Digitalin, digitonin, digitoxin, digitalein, digitin, digitophyllin, digitoflavin, resin, pectin	*U. S. Prep.*—Fluidextractum Digitalis, Infusum Digitalis. *N. F. Prep.*—Pilulæ Digitalis, Scillæ et Hydrargyri
Quassia	Tonic; gr. viii (0.5 Gm.)	Mucilage, resin, picrasmin	*U. S. Prep.*—Tinctura Quassiæ. *N. F. Prep.*—Extractum Quassiæ, Fluidextractum Quassiæ
Belladonna Leaves	Sedative; gr. i (0.065 Gm.)	Atropine, hyoscyamine, belladonnine	*U. S. Prep.*—Extractum Belladonnæ Foliorum, Tinctura Belladonnæ Foliorum, Unguentum Belladonnæ. *N. F. Prep.*—Pilulæ Aloes et Podophylli Compositæ, Pilulæ Aloini Compositæ, Pilulæ Aloini, Strychninæ et Belladonnæ, Pilulæ Aloini, Strychninæ et Belladonnæ Compositæ, Pilulæ Antidyspepticæ, Pilulæ Laxativæ Compositæ
Belladonna Root	Sedative; gr. ¾ (0.045 Gm.)	Atropine, hyoscyamine, belladonnine	*U. S. Prep.*—Fluidextractum Belladonnæ Radicis, Linimentum Belladonnæ
Capsicum	Stimulant; gr. i (0.065 Gm.)	Capsaicin, fixed oil, capsicin	*U. S. Prep.*—Oleoresina Capsici, Tinctura Capsici. *N. F. Prep.*—Mistura Chloroformi et Morphinæ Composita, Mistura Opii et Chloroformi Composita, Mistura Opii et Rhei Composita, Pulvis Aromaticus Rubefaciens, Pulvis Myricæ Compositus, Tinctura Capsici et Myrrhæ

Family and Official Name	Botanical Name*	Synonym	Part used, or Description	Habitat
Hyoscyamus	H. niger	Henbane	Leaves and flowering tops	Europe and Asia
Stramonium	Datura Stramonium or Datura Tatula	Jamestown Weed, Jimson Weed	Leaves	Asia, nat.
Sterculiaceæ Oleum Theobromatis	Theobroma Cacao	Butter of Cacao, Cacao Butter	Fixed oil	South America
Styraceæ Benzoinum	Styrax Benzoin and other species	Gum Benjamin	Balsamic resin	East Indies
Thymeleaceæ Mezereum	Daphne M., Daphne Gnidium, and others	Mezereon	Bark	Europe
Ulmaceæ Ulmus	U. fulva	Slippery Elm	Inner bark	North America
Umbelliferæ Anisum	Pimpinella A. *	Aniseed	Fruit	Asia, cult.
Asafœtida	Ferula fœtida and others	. . . . . .	Gum-resin	Persia
Carum	C. Carvi	Caraway Seed	Dried fruit	Central and Western Asia, cult.
Coriandrum	C. sativum	Coriander Seed	Dried, ripe fruit	Europe, cult.
Fœniculum	F. vulgare	Fennel Seed	Dried, nearly ripe fruit	Southern Europe, cult.
Oleum Anisi	Pimpinella Anisum	Anis Oil	Volatile oil	. . . .
Oleum Cari	Carum Carvi	Caraway Oil	Volatile oil	. . . .
Oleum Coriandri	Coriandrum sativum	Coriander Oil	Volatile oil	. . . .
Oleum Fœniculi	Fœniculum vulgare	Fennel Oil	Volatile oil	. . . .
Petroselinum	Petroselinum sativum	Parsley Seed	Dried ripe fruit	Southern Europe, Asia Minor
Sumbul	Ferula S.	Musk-root	Rhizome and root	Asia
Valerianaceæ Valeriana	V. officinalis	. . . . . .	Rhizome and roots	Europe, nat.

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Hyoscyamus	Narcotic; gr. iv (0.25 Gm.)	Hyoscyamine, hyoscine	*U. S. Prep.*—Extractum Hyoscyami, Fluidextractum Hyoscyami, Tinctura Hyoscyami. *N. F. Prep.*—Pilulæ Catharticæ Vegetabiles, Pilulæ Colocynthidis et Hyoscyami, Pilulæ Laxativæ Post Partum
Stramonium	Narcotic; gr. i (0.065 Gm.)	Mucilage, hyoscyamine, hyoscine, atropine	*U. S. Prep.*—Extractum Stramonii, Tinctura Stramonii, Unguentum Stramonii. *N. F. Prep.*—Fluidextractum Stramonii
Oil of Theobroma	Emollient	Stearin, palmitin, olein	*N. F. Prep.*—Trochisci Quininæ Tannatis
Benzoin	Stimulant; gr. xv (1 Gm.)	Benzoic acid, cinnamic acid	*U. S. Prep.*—Adeps Benzoinatus (Siam Benzoin), Tinctura Benzoini, Tinctura Benzoini Composita. *N. F. Prep.*—Sevum Benzoinatus, Unguentum Picis Compositum
Mezereum	Sialagogue, stimulant	Soft acrid resin, daphnin	*U. S. Prep.*—Fluidextractum Sarsaparillæ Compositum. *N. F. Prep.*—Decoctum Sarsaparillæ Compositum, Fluidextractum Mezerei, Linimentum Sinapis Compositum
Elm	Demulcent	Mucilage	*N. F. Prep.*—Trochisci Ulmi
Anise	Stimulant; gr. viii (0.5 Gm.)	Volatile oil, fixed oil	*N. F. Prep.*—Species Laxativæ, Species Pectorales, Tinctura Rhei Dulcis
Asafetida	Nervine; gr. iv (0.25 Gm.)	Volatile oil, gum-resin	*U. S. Prep.*—Emulsum Asafœtidæ, Pilulæ Asafœtidæ, Tinctura Asafœtidæ. *N. F. Prep.*—Mistura Magnesiæ, Asafœtidæ et Opii, Pilulæ Aloes et Asafœtidæ
Caraway	Stimulant; gr. xv (1 Gm.)	Volatile oil, resin, little tannin	*U. S. Prep.*—Tinctura Cardamomi Composita
Coriander	Stimulant; gr. viii (0.5 Gm.)	Volatile oil, mucilage	*N. F. Prep.*—Fluidextractum Stillingiæ Compositum, Infusum Gentianæ Compositum
Fennel	Stimulant; gr. xv (1 Gm.)	Volatile and fixed oil	*U. S. Prep.*—Infusum Sennæ Compositum. *N. F. Prep.*—Pilulæ Antiperiodicæ, Pilulæ Antiperiodicæ sine Aloe, Species Laxativæ, Tinctura Antiperiodica, Tinctura Antiperiodica sine Aloe
Oil of Anise, Oil of Star Anise	Carminative; ♏iii (0.2 mil)	$C_{10}H_{16}$, and anethol, $C_{10}H_{12}O$	(See Magnoliaceæ)
Oil of Caraway	Stimulant; ♏iii (0.2 mil)	Carvene, $C_{10}H_{16}$, and carvol, $C_{10}H_{14}O$	*U. S. Prep.*—Spiritus Juniperi Compositus. *N. F. Prep.*—Elixir Cardamomi Compositum, Mistura Carminativa, Pilulæ Aloes, Hydrargyri et Scammoniæ Compositæ, Spiritus Cardamomi Compositus
Oil of Coriander	Stimulant; ♏iii (0.2 mil)	$C_{10}H_{18}O$	*U. S. Prep.*—Elixir Aromaticum, Fluidextractum Cascaræ Sagradæ Aromaticum, Spiritus Aurantii Compositus, Syrupus Sennæ. *N. F. Prep.*—Confectio Sennæ
Oil of Fennel	Stimulant; ♏iii (0.2 mil)	$C_{10}H_{16}O$, and anethol, $C_{10}H_{12}O$	*U. S. Prep.*—Aqua Fœniculi, Pulvis Glycyrrhizæ Compositum, Spiritus Juniperi Compositus. *N. F. Prep.*—Elixir Anisi, Elixir Glycyrrhizæ Aromaticum, Fluidglyceratum Cascaræ Sagradæ Aromaticum, Mistura Carminativa, Pilulæ ad Prandium, Syrupus Ficorum Compositus, Syrupus Rhamni Catharticus
Parsley Fruit	Emmenagogue, Antiperiodic	Apiol	*U. S. Prep.*—Oleoresina Petrosolini
Sumbul	Stimulant; gr. xxx (2 Gm.)	Volatile oil, resin	*U. S. Prep.*—Extractum Sumbul, Fluidextractum Sumbul, Tinctura Sumbul
Valerian	Nervine; gr. xxx (2 Gm.)	Valeric, formic, and acetic acids	*U. S. Prep.*—Tinctura Valerianæ, Tinctura Valerianæ Ammoniata. *N. F. Prep.*—Fluidextractum Valerianæ

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Zingiberaceæ Cardamomi Semen	Elettaria C.	Cardamon	Dried seeds	Malabar, cult.
Zingiber	Z. officinale	. . . . . .	Dried rhizome	West Indies, India
Zygophyllaceæ Guaiacum	G. officinale or G. sanctum	Guaiac Resin	Resin of wood	West Indies and South America

CONDENSED CHART OF THE N. F. VEGETABLE

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Anacardiaceæ Mastiche	Pistacia Lentiscus	. . . . . .	Concrete resinous exudation	Mediterranean region
Rhus Glabra	R. glabra	Sumac Berries	Dried ripe fruit	Canada and the United States
Apocynaceæ Apocynum	A. cannabinum	Canadian Hemp	Rhizome and roots	Canada
Araliaceæ Aralia	A. racemosa	American Spikenard, Spignet	Rhizome and roots	Eastern and Central United States
Aristolochiaceæ Asarum	A. canadense	Wild Ginger, Canada Snake-root	Rhizome and roots	Northern United States and Canada
Asclepiadaceæ Asclepias	A. tuberosa	Pleurisy Root	Roots	Eastern United States
Condurango	Marsdenia C.	. . . . . .	Dried bark	Ecuador and Columbia
Berberidaceæ Berberis	Odostemon (species), Berberis (genus)	Oregon Grape Root	Rhizome and roots	Western United States and Canada
Caulophyllum	C. thalictroides	Blue Cohosh	Rhizome and roots	Eastern United States
Betulaceæ Oleum Betulæ Empyreumaticum Rectificatum	Betula alba	Oleum Rusci Rectificatum	Pyroligneous oil from dry distillation of bark and wood	United States
Cactaceæ Cactus Grandiflorus	C. grandiflorus	Night Blooming Cerus	Fresh succulent stems	Southern North America

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Cardamom Seed	Stimulant; gr. xv (1 Gm.)	Volatile oil, fixed oil	*U. S. Prep.*—Extractum Colocynthidis Compositum, Fluidextractum Aromaticum, Pulvis Aromaticus, Tinctura Cardamomi, Tinctura Cardamomi Composita, Tinctura Gentianæ Composita, Tinctura Rhei, Pulvis Cretæ Aromaticus. *N. F. Prep.*—Tinctura Aromatica, Tinctura Rhei Dulcis, Vinum Rhei Compositum
Ginger	Stimulant; gr. xv (1 Gm.)	Volatile oil, resin	*U. S. Prep.*—Fluidextractum Aromaticum, Fluidextractum Zingiberis, Oleoresina Zingiberis, Pulvis Aromaticus, Pulvis Rhei Compositus, Syrupus Zingiberis, Tinctura Zingiberis. *N. F. Prep.*—Elixir Rubi Compositum, Pulvis Aromaticus Rubefaciens, Pulvis Myricæ Compositus, Tinctura Antiperiodicæ, Tinctura Antiperiodicæ sine Aloe, Tinctura Aromatica
Guaiac	Antirheumatic; gr. xv (1 Gm.)	Guaiaretic acid, guaiaconic acid, guaiacic acid	*U. S. Prep.*—Tinctura Guaiaci, Tinctura Guaiaci Ammoniata. *N. F. Prep.*—Gargarisma Guaiaci Compositum, Glyceritum Guaiaci, Mistura Guaiaci, Pilulæ Antimonii Compositæ, Tinctura Guaiaci Composita

DRUGS, WITH THEIR PREPARATIONS

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Mastic	Stomachic; gr. xxx (2 Gm.)	Resin	*N. F. Prep.*—Pilulæ ad Prandium, Pilulæ Aloes et Mastiches
Rhus Glabra	Astringent, refrigerant; gr. xv (1 Gm.)	Tannic and gallic acids	*N. F. Prep.*—Fluidextractum Rhois Glabræ
Apocynum	Emetic; antiperiodic; gr. xii (0.75 Gm.)	Apocynin, starch, apocynein, resin	*N. F. Prep.*—Fluidextractum Apocyni
Aralia	Diaphoretic; gr. xxx (2 Gm.)	Volatile oil, resin	*N. F. Prep.*—Fluidextractum Araliæ, Syrupus Pini Strobi Compositus, Syrupus Pini Strobi Compositus cum Morphina
Asarum	Aromatic stimulant; gr. xxx (2 Gm.)	Asarol, a fragrant resin	*N. F. Prep.*—Syrupus Asari Compositus
Asclepias	Emetic, cathartic; gr. xxx (2 Gm.)	Asclepiadin	*N. F. Prep.*—Fluidextractum Asclepiadis
Condurango	Alterative; gr. lx (4 Gm.)	Condurangin	*N. F. Prep.*—Fluidextractum Condurango
Berberis	Astringent, cathartic; gr. xxx (2 Gm.)	Berberine, berbamine, oxyacanthine	*N. F. Prep.*—Fluidextractum Berberidis
Caulophyllum	Antispasmodic, diuretic; gr. viii (0.5 Gm.)	Caulophylline, leontin	*N. F. Prep.*—Fluidextractum Caulophylli
Rectified Oil of Birch Tar	Antizymotic	Empyreumatic products	*N. F. Prep.*—Unguentum Resorcinolis Compositum
Cactus Grandiflorus	Cardiac stimulant	Glucosidal bodies, etc.	*N. F. Prep.*—Tinctura Cacti Grandiflori

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Canellaceæ Canella	C. Winterana	. . . . . .	Dried inner bark	Antilles, Southern Florida
Caprifoliaceæ Sambucus	S. Canadensis or S. nigra	Elder Flowers	Air-dried flowers	United States and Canada
Viburnum Opulus	V. Opulus	High Bush Cranberry Bark	Dried bark	North America
Celastraceæ Euonymus	Euonymus atropurpureus	Wahoo Bark	Bark of the roots	Eastern and Central United States
Cistaceæ Helianthemum	H. canadense	Rock-rose Frost Weed	Dried herb	Eastern United States
Compositæ Absinthium	Artemisia A.	Wormwood	Dried leaves and flowering tops	Europe and North Africa
Calendula	C. officinalis	Marigold	Dried ligulate florets	Southern Europe
Echinacea	Brauneria pallida	. . . . . .	Rhizome and roots	Southwestern United States
Eupatorium	E. perfoliatum	Boneset	Dried leaves and flowering tops	Eastern and Central United States
Farfara	Tussilago F.	Coltsfoot Leaves	Dried leaves	Europe
Inula	I. Helemium	Elecampane	Rhizome and roots	Central Europe and Asia
Lappa	Arctium L.	Burdock Root	Root	Europe and Northern Asia
Senecio	S. aureus	Life Root	Overground portion	Europe
Cornaceæ Cornus	C. florida	Dogwood Bark	Bark of the root	United States
Cucurbitaceæ Bryonia	B. alba or B. dioica	Bryony	Root	Southern Europe and Asia
Dioscoreaceæ Dioscorea	D. villosa	Wild Yam Root	Rhizome	United States
Droseraceæ Drosera	D. rotundifolia, D. intermedia, D. longifolia	Sundew	Air-dried flowering plant	North Carolina
Ericaceæ Chimaphila	C. umbellata	Pipsissewa	Dried leaves	United States and Canada, Northern Europe and Siberia
Euphorbiaceæ Cascarilla	Croton Eluteria	Sweet Bark	Dried Bark	Bahama Islands, Florida
Euphorbia Pilulifera	E. pilulifera	Pill Bearing Spurge	Dried Herb	Tropical countries
Fagaceæ Castanea	C. dentata	Chestnut Leaves	Dried Leaves	North America
Quercus	Q. alba	White Oak Bark	Dried bark	Eastern and Central United States and Canada

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Canella	Tonic, stimulant aromatic; gr. xxx (2 Gm.)	Volatile oil, mannitol, resin	*N. F. Prep.*—Pulvis Aloes et Canellæ
Sambucus	Stimulant, carminative; gr. lx (4 Gm.)	Mucilage, resin, volatile oil	*N. F. Prep.*—Fluidextractum Stillingiæ Compositum, Species Laxativæ
Viburnum Opulus	Nerve sedative, antispasmodic; gr. xxx (2 Gm.)	Resin, viburnin, tannin	*N. F. Prep.*—Elixir Viburni Opuli Compositum, Fluidextractum Viburni Opuli, Tinctura Viburni Opuli Composita
Euonymus	Tonic, laxative; gr. viii (0.5 Gm.)	Euonymin, euonic acid	*N. F. Prep.*—Extractum Euonymi, Fluidextractum Euonymi
Helianthemum	Tonic, astringent; gr. lx (4 Gm.)	Volatile oil	*N. F. Prep.*—Fluidextractum Helianthemi
Absinthium	Tonic stomachic, anthelmintic; gr. xxx (2 Gm.)	Absinthin, resin, starch, tannin	*N. F. Prep.*—Vinum Aurantii Compositum
Calendula	Stimulant, alterative; gr. xv (1 Gm.)	Volatile oil, calendulin resin	*N. F. Prep.*—Fluidextractum Calendulæ, Tinctura Calendulæ
Echinacea	Alterative, antisyphilitic; gr. xv (1 Gm.)	An acrid resin and a minute amount of an alkaloid	*N. F. Prep.*—Fluidextractum Echinaceæ
Eupatorium	Stimulant, laxative; gr. xxx (2 Gm.)	Eupatorin, resin	*N. F. Prep.*—Fluidextractum Eupatorii
Coltsfoot	Demulcent, tonic; gr. lx (4 Gm.)	Resin, tannin	*N. F. Prep.*—Species Pectorales
Inula	Diuretic, expectorant; gr. xxx (2 Gm.)	Inulin	*N. F. Prep.*—Pilulæ Antiperiodicæ, Pilulæ Antiperiodicæ sine Aloe, Tinctura Antiperiodica, Tinctura Antiperiodica sine Aloe
Lappa	Diuretic, alterative; gr. xxx (2 Gm.)	Inulin, lappin	*N. F. Prep.*—Fluidextractum Lappæ
Senecio	Diuretic, emmenagogue; gr. lx (4 Gm.)	Senecine and senecionine	*N. F. Prep.*—Fluidextractum Senecionis
Cornus	Astringent; gr. xxx (2 Gm.)	Cornin, resin	*N. F. Prep.*—Fluidextractum Corni
Bryonia	Cathartic, diuretic; gr. xv (1 Gm.)	Bryonin, bryogenin, bryonidin, gum, sugar	*N. F. Prep.*—Tinctura Bryoniæ
Dioscorea	Diaphoretic, expectorant; gr. lx (4 Gm.)	Resin, and saponin-like principle	*N. F. Prep.*—Fluidextractum Dioscoreæ, Tinctura Viburni Opuli Composita
Drosera	Pectoral, rubefacient; gr. lx (4 Gm.)	An acid resin, citric and malic acids and a ferment	*N. F. Prep.*—Fluidextractum Droseræ
Chimaphila	Tonic, astringent, diuretic; gr. xxx (2 Gm.)	Arbutin, ericolin, chimaphilin, urson, sugar, gum	*N. F. Prep.*—Fluidextractum Chimaphilæ, Fluidextractum Stillingiæ Compositum
Cascarilla	Stimulant, tonic; gr. xxx (2 Gm.)	Cascarillin, tannin, volatile oil	*N. F. Prep.*—Vinum Aurantii Compositum
Euphorbia Pilulifera	Expectorant, antispasmodic; gr. xxx (2 Gm.)	Acrid resin	*N. F. Prep.*—Fluidextractum Euphorbiæ Piluliferæ
Castanea	Sedative; gr. lx (4 Gm.)	Tannin and mucilage	*N. F. Prep.*—Fluidextractum Castaneæ
Quercus	Astringent; gr. xv (1 Gm.)	Quercitannic acid, oak-red, quercit	*N. F. Prep.*—Tinctura Quercus

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Fucaceæ Fucus	F. vesiculosus	Bladderwrack	Dried thallus	. . . .
Fumariaceæ Corydalis	Bicuculla canadensis, mixed with Bicuculla Cucullaria	Turkey Corn, Squirrel Corn	Dried tubers	United States
Gentianaceæ Centaurium	Erythræa C.	. . . . . .	Dried flowering plant	United States
Chirata	Swertia Chirayita	. . . . . .	Dried plant	Northern India
Menyanthes	M. trifoliata	Buckbean	Leaves	Europe and North America
Geraniac Geranium	G. maculatum	Cranesbill	Rhizome	Eastern and Central United States and Canada
Gramineæ Zea	Z. Mays	Corn Silk	Styles and stigmas	North America
Hamamelidaceæ Hamamelidis Folia	H. virginiana	Witch Hazel Leaves	Leaves	Eastern and Central United States
Iridaceæ Crocus	C. sativa	Saffron	Stigmas	Spain and United States, cult.
Iris	I. florentina, I. germanica, I. pallida	Orris Root	Rhizome	Middle and Southern Europe
Iris Versicolor	Iris versicolor	. . . . . .	Rhizome	Eastern United States
Juglandaceæ Juglans	J. cinerea	Butternut Bark	Dried inner bark of the roots	United States
Labiatæ Cataria	Nepeta C.	Catmint	Leaves and flowering tops	Europe
Scutellaria	S. lateriflora	Skullcap	Dried plant	United States, Canada
Thymus	T. vulgaris	. . . . . .	Dried tops	Southern France
Lauraceæ Sassafras Medulla	S. variifolium	. . . . . .	Dried pith	Eastern North America
Leguminosæ Baptisia	B. tinctoria	Wild Indigo	Roots	United States and Canada
Cassia Fistula	Cathartocarpus Fistula	Purging Cassia	Dried fruit	India
Galega	G. officinalis	European Goat's Rue	Dried flowering tops	Southern Europe
Hæmatoxylon	H. campechianum	Logwood	Heart-wood	Central America
Krameria	K. triandra, K. Ixina, K. argentea	Rhatany	Root	South America, Mexico and West Indies
Melilotus	M. officinalis	Yellow Sweet Clover	Leaves and flowering tops	Eastern United States
Scoparius	Cytisus S.	Broom Tops	Dried tops	Europe

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Fucus	Alterative; gr. x (0.65 Gm.)	Iodine	*N. F. Prep.*—Fluidextractum Fuci
Corydalis	Tonic, Antisyphilitic; gr. x (0.65 Gm.)	Corydaline, fumaric acid	*N. F. Prep.*—Elixir Corydalis Compositum, Fluidextractum Corydalis, Fluidextractum Stillingiæ Compositum
Centaury	Tonic, febrifuge; gr. xxx (2 Gm.)	Bitter glucoside	*N. F. Prep.*—Tinctura amara
Chirata	Tonic, febrifuge; gr. xv. (1 Gm.)	Ophelic acid, chiratin	*N. F. Prep.*—Fluidextractum Chiratæ
Menyanthes	Tonic, emmenagogue; gr. xv (1 Gm.)	Menyanthin	*N. F. Prep.*—Vinum Aurantii Compositum
Geranium	Tonic, astringent; gr. xv (1 Gm.)	Tannin, starch	*N. F. Prep.*—Fluidextractum Geranii
Zea	Diuretic, lithontriptic; gr. lx (4 Gm.)	Volatile oil, maizenic acid	*N. F. Prep.*—Fluidextractum Zeæ
Hamamelidis Leaves	Hemostatic, astringent; gr. xxx (2 Gm.)	Tannin, volatile oil	*N. F. Prep.*—Fluidextractum Hamamelidis Foliorum
Crocus	Antispasmodic	Crocin, coloring principle	*N. F. Prep.*—Pilulæ Antiperiodicæ, Pilulæ Antiperiodicæ sine Aloe, Tinctura Antiperiodica, Tinctura Antiperiodica sine Aloe, Tinctura Croci, Tinctura Opii Crocata, Tinctura Zedoariæ Amara
Orris	Diuretic, errhine	Volatile oil	*N. F. Prep.*—Species Pectorales
Blue Flag	Emetic, diuretic; gr. xxx (2 Gm.)	Acrid resins, volatile oil	*N. F. Prep.*—Elixir Corydalis Compositum, Fluidextractum Iridis Versicoloris, Fluidextractum Stillingiæ Compositus
Juglans	Cathartic, tonic; gr. lx (4 Gm.)	Resin, tannin, gum, sugar	*N. F. Prep.*—Elixir Cascaræ Sagradæ Compositum, Fluidextractum Juglandis
Catnep	Carminative, stimulant; gr. lx (4 Gm.)	Volatile oil, tannin	*N. F. Prep.*—Fluidextractum Catariæ
Scutellaria	Tonic, antispasmodic; gr. xv (1 Gm.)	Scutellarin	*N. F. Prep.*—Fluidextractum Scutellariæ, Tinctura Viburni Opuli Composita
Thyme	Carminative, antispasmodic; gr. lx (4 Gm.)	Volatile oil, thymol	*N. F. Prep.*—Fluidextractum Thymi
Sassafras Pith	Demulcent	Mucilage	*N. F. Prep.*—Mucilago Sassafras Medullæ
Baptisia	Laxative, gr. xv (1 Gm.)	Cytisine, baptisin, baptin, pseudobaptisin	*N. F. Prep.*—Fluidextractum Baptisiæ
Cassia Fistula	Laxative, gr. lx (4 Gm.)	Sugar, pectin	*N. F. Prep.*—Confectio Sennæ
Galega	Galactagogue; gr. lx (4 Gm.)	. . . .	*N. F. Prep.*—Fluidextractum Galegæ
Hematoxylon	Astringent, tonic; gr. xv (1 Gm.)	Coloring principle, hematoxylin, hematein	*N. F. Prep.*—Extractum Hæmatoxylon
Krameria	Astringent, tonic; gr. xv (1 Gm.)	Krameric acid, tannin	*N. F. Prep.*—Extractum Krameriæ, Fluidextractum Krameriæ, Fluidglyceratum Krameriæ, Pulvis Gambir Compositus, Syrupus Krameriæ, Tinctura Krameriæ
Melilot	Stimulant, antispasmodic	Coumarin	*N. F. Prep.*—Species Emollientes
Scoparius	Cathartic, diuretic; gr. xv (1 Gm.)	Sparteine, scoparin, volatile oil	*N. F. Prep.*—Fluidextractum Scoparii

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Tamarindus	T. indica	. . . . . .	Preserved pulp	Tropical Africa
Trifoliuæ	T. pratense	Red Clover Blossoms	Inflorescence	Europe
Liliaceæ Aletris	A. farinosa	Unicorn Root, Star Grass	Rhizome and roots	United States
Allium	A. sativum	. . . . . .	Fresh bulb	North America
Convallariæ Flores	C. majalis	Lily-of-the-Valley Flowers	Dried inflorescence	Europe, Asia, Eastern United States
Convallariæ Radix	C. majalis	Lily-of-the-Valley Root	Rhizome and roots	Europe, Asia, Eastern United States
Helonias	Chamælirium luteum	False Unicorn	Rhizome and roots	United States
Trillium	T. erectum	Beth Root	Rhizome	United States
Loganiaceæ Ignatia	Strychnos Ignatii	Saint Ignatius Bean	Dried seed	Philippine Islands
Malvaceæ Althæa Folia	A. officinalis	Marsh Mallow Leaves	Leaves	Central and Southern Europe
Gossypii Cortex	G. herbaceum, G. Barbadense or G. arboreum	. . . . . .	Recently gathered dried bark of the root	United States, Asia and Africa
Malvæ Folia	M. sylvestris, M. rotundifolia	. . . . . .	Leaves	Europe
Meliaceæ Cocillana	Guarea Rusbyi	. . . . . .	Dried bark	Bolivia
Menispermaceæ Cocculus Indicus	Anamirta C.	Fish Berry	Dried fruit	East Indies
Pareira	Chondodendron tomentosum	Pareira Brava	Dried roots	Brazil and Peru
Monimiaceæ Boldo	Boldu Boldus	Boldo Leaves	Leaves	Chile
Moraceæ Ficus	Ficus Carica	. . . . . .	Partially dried fruit	Persia
Lupulinum	Humulus Lupulus	. . . . . .	Granular trichomes	Europe, Asia and North America
Myricaceæ Myrica	M. cerifera	. . . . . .	Bark of the root	United States
Myristicaceæ Macis	Myristica fragrans	. . . . . .	Arillode of the seed	Molucca Islands
Myrtaceæ Oleum Myrciæ	Pimenta acris	Oil of Bay	Volatile oil from leaves	West Indies
Pimenta	P. officinalis	Allspice	Dried, nearly ripe fruit	West Indies, Mexico, Central America
Oleaceæ Chionanthus	C. virginica	Fringe Tree Bark	Bark of the root	Southern United States
Fraxinus	F. americana	. . . . . .	Dried bark	United States

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Tamarind	Laxative, refrigerant; ʒiv (16 Gm.)	Tartaric and citric acids, tannin	*N. F. Prep.*—Confectio Sennæ
Trifolium	Alterative, expectorant; gr. lx (4 Gm.)	. . . .	*N. F. Prep.*—Fluidextractum Trifolii
Aletris	Antirheumatic, diuretic; gr. xxx (2 Gm.)	Starch	*N. F. Prep.*—Elixir Viburni Opuli Compositum, Fluidextractum Aletridis
Garlic	Expectorant, carminative; gr. xxx (2 Gm.)	Volatile Oil	*N. F. Prep.*—Syrupus Allii
Convallaria Flowers	Cardiac stimulant, diuretic; gr. viii (0.5 Gm.)	Convallamarin, volatile crystalline, aromatic principle	*N. F. Prep.*—Fluidextractum Convallariæ Florum
Convallaria Root	Cardiac stimulant, cathartic; gr. viii (0.5 Gm.)	Convallamarin, convallarin	*N. F. Prep.*—Fluidextractum Convallariæ Radicis
Helonias	Tonic, diuretic; gr. xxx (2 Gm.)	Chamaelirin	*N. F. Prep.*—Fluidextractum Heloniadis
Trillium	Emmenagogue, emetic; gr. xxx (2 Gm.)	Volatile oil, tannin	*N. F. Prep.*—Elixir Viburni Opuli Compositum, Fluidextractum Trillii
Ignatia	Tonic, nervine; gr. i (0.065 Gm.)	Strychnine, brucine, igasuric acid	*N. F. Prep.*—Extractum Ignatiæ, Tinctura Ignatiæ
Althæa Leaves	Demulcent, emollient; gr. xxx (2 Gm.)	Mucilage	*N. F. Prep.*—Species Emollientes
Cotton Root Bark	Emmenagogue, oxytocic; gr. xxx (2 Gm.)	Fixed oil, and resin	*N. F. Prep.*—Fluidextractum Gossypii Corticis
Mallow Leaves	Emollient, demulcent	Mucilage	*N. F. Prep.*—Species Emollientes
Cocillana	Expectorant, cathartic; gr. xv (1 Gm.)	Resins, active principle	*N. F. Prep.*—Fluidextractum Cocillanæ
Cocculus Indicus	Vermicide, narcotic	Picrotoxin, menispermine, hydropicrotoxin	*N. F. Prep.*—Tinctura Cocculi Indici
Pareira	Diuretic, tonic; gr. xxx (2 Gm.)	Pelosine, wax, starch	*N. F. Prep.*—Fluidextractum Pareiræ
Boldo	Tonic, hepatic; gr. viii (0.5 Gm.)	Volatile oil, boldine	*N. F. Prep.*—Fluidextractum Boldi
Fig	Laxative; gr. xxx (2 Gm.)	Grape sugar, starch	*N. F. Prep.*—Confectio Sennæ, Syrupus Ficorum Compositus
Lupulin	Antispasmodic, sedative; gr. viii (0.5 Gm.)	Volatile oil	*N. F. Prep.*—Fluidextractum Lupulini, Oleoresina Lupulini
Bayberry Bark	Astringent, tonic; gr. viii (0.5 Gm.)	Volatile oil, resin	*N. F. Prep.*—Pulvis Myricæ Compositus
Mace	Flavor, aromatic; gr. viii (0.5 Gm.)	Myristicin, volatile oil	*N. F. Prep.*—Elixir Rubi Compositum
Oil of Myrcia	Perfume	. . . .	*N. F. Prep.*—Spiritus Myrciæ Compositus
Pimenta	Aromatic, carminative; gr. xv (1 Gm.)	Volatile oil, eugenol, tannin	*N. F. Prep.*—Tinctura Guaiaci Composita
Chionanthus	Tonic, diuretic; gr. xxx (2 Gm.)	Saponin, bitter principle	*N. F. Prep.*—Fluidextractum Chionanthi
White Ash Bark	Tonic, antiperiodic; gr. xxx (2 Gm.)	Fraxin, fraxetin	*N. F. Prep.*—Vinum Fraxini

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Orchidaceæ				
Cypripedium	C. hirsutum, C. pubescens or C. parviflorum	Lady Slipper Root	Rhizome and roots	Eastern and Central United States and Canada
Vanilla	V. panifolia	Vanilla Bean	Full-grown unripe fruit	Eastern Mexico
Papaveraceæ				
Papaveris Fructus	Papaver somniferum	. . . . . .	Full-grown unripe fruit	China
Paracoto	Unidentified	. . . . . .	Bark	Northern Bolivia
Passifloraceæ				
Passiflora	P. incarnata	Passion Vine	Dried herbage	Southern United States
Persio	Roccella or Lecanora species	. . . . . .	Purplish-red powder from lichens	. . . .
Phytolaccaceæ				
Phytolacca	P. decandra	Poke Root	Root	Eastern North America
Pinaceæ				
Juniperus	J. communis	. . . . . .	Dried ripe fruit	North America, Europe and Asia
Pinus Alba	P. Strobus	. . . . . .	Inner bark	Northern United States
Terebinthina	Pinus palustris and others	Gum Thus, Gum Turpentine	Concrete oleoresin	Southern United States
Terebinthina Laricis	Larix europœa	Larch Turpentine	Viscid oleoresin	Europe
Thuja	T. occidentalis	Arbor Vitæ	Leafy young twigs	United States and Canada
Piperaceæ				
Kava	Piper methysticum	Kava Kava	Rhizome and roots	Sandwich Islands
Matico	Piper angustifolium	. . . . . .	Dried leaves	Peru and Bolivia
Polygonaceæ				
Rumex	R. crispus or R. obtusifolius	Yellow Dock	Roots	United States and Canada
Polyporaceæ				
Agaricus	Polyporus officinalis	White Agaric, Larch Agaric	Dried fruit body	Northern Asia
Ranunculaceæ				
Adonis	A. vernalis	Pheasant's Eye	Dried over-ground portion	Europe and Asia
Coptis	C. trifolia	Goldthread	Dried plant	United States

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Cypripedium	Stimulant, diaphoretic; gr. xv (1 Gm.)	Volatile oil, resin, tannin	*N. F. Prep.*—Fluidextractum Cypripedii
Vanilla	Stimulant, carminative	Vanillin, sugar, resin	*N. F. Prep.*—Elixir Ammonii Valeratis, Elixir Humuli, Elixir Strychninæ Valeratis, Syrupus Bromidorum, Tinctura Vanillæ
Poppy Capsules	Sedative, anodyne; gr. lx (1 Gm.)	Morphine, Narcotine	*N. F. Prep.*—Syrupus Papaveris
Paracoto	Astringent, antizymotic; gr. v (0.3 Gm.)	Cotoin, volatile oil, etc.	*N. F. Prep.*—Fluidextractum Paracoto, Tinctura Paracoto
Passion Flower	Narcotic, anodyne; gr. iii (0.2 Gm.)	Not known	*N. F. Prep.*—Tinctura Passifloræ
Cudbear	Coloring agent	. . . .	*N. F. Prep.*—Elixir Ammonii Valeratis, Elixir Aromaticum Rubrum, Elixir Cinchonæ Alkaloidorum, Elixir Quininæ Valeratis et Strychninæ, Elixir Strychninæ Valeratis, Elixir Trium Bromidorum, Liquor Antisepticus Alkalinus, Syrupus Bromidorum, Syrupus Phosphatum Compositus, Syrupus Pini Strobi Compositus, Syrupus Pini Strobi Compositus cum Morphinæ, Tinctura Persionis, Tinctura Persionis Composita
Phytolacca	Emetic, alterative; gr. iss–xv (0.1–1 Gm.)	Phytolaccine, phytolaccic acid	*N. F. Prep.*—Fluidextractum Phytolaccæ
Juniper Berries	Stimulant, diuretic; gr. lx (4 Gm.)	Volatile oil, resin	*N. F. Prep.*—Elixir Buchu Compositum, Elixir Potassii Acetatis et Juniperi, Fluidextractum Buchu Compositum, Fluidextractum Juniperi
White Pine Bark	Expectorant; gr. xxx (2 Gm.)	Tannin, gum, resin	*N. F. Prep.*—Syrupus Pini Strobi Compositus, Syrupus Pini Strobi Compositus cum Morphina
Turpentine	Stimulant	Resin, volatile oil	*N. F. Prep.*—Ceratum Resinæ Compositum
Venice Turpentine	Stimulant, diuretic	Volatile oil, resin	*N. F. Prep.*—Petroxolinum Terebinthinæ Laricis
Thuja	Emmenagogue, stimulant; gr. xxx (2 Gm.)	Thujin, resin, pinipicrin	*N. F. Prep.*—Fluidextractum Thujæ
Kava	Tonic, stimulant; gr. xv (1 Gm.)	Volatile oil, resin	*N. F. Prep.*—Fluidextractum Kavæ
Matico	Stimulant, hemostatic; gr. lx (4 Gm.)	Volatile oil, resin, artanthic acid	*N. F. Prep.*—Fluidextractum Matico
Rumex	Astringent, tonic; gr. lx (4 Gm.)	Rumicin, nepodin, tannin, lapodin	*N. F. Prep.*—Fluidextractum Rumicis
Agaric	Counterirritant, internally in phthisis; gr. x (0.6 Gm.)	Agaricin	*N. F. Prep.*—Pilulæ Antiperiodicæ, Pilulæ Antiperiodicæ sine Aloe, Tinctura Antiperiodica, Tinctura Antiperiodica sine Aloe, Tinctura Zedoariæ Amara
Adonis	Cardiac stimulant, diuretic; gr. ii (0.13 Gm.)	Adonidin, adonin	*N. F. Prep.*—Fluidextractum Adonidis
Coptis	Tonic; gr. xxx (2 Gm.)	Berberine, coptine	*N. F. Prep.*—Fluidextractum Coptis

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Delphinium	D. Consolida or D. Ajacis	. . . . . .	Dried seed	Southern Europe and Asia Minor
Pulsatilla	Anemone P. or A. pratensis or A. Ludoviciana	Pasque Flower, Meadow Anemone	Dried herb	Europe
Rhamnaceæ Rhamnus Cathartica	R. cathartica	Buckthorn Berries	Dried ripe fruit	Central and Southern Europe and Asia
Rosaceæ Brayera	Hagenia abyssinica	Kousso, Cusso	Panicles of pistillate flowers	Northern Africa
Prunum	Prunus domestica	. . . . . .	Partly dried ripe fruit	Southern Europe
Quillaja	Q. saponaria	Soap-tree Bark	Dried bark	Chile and Peru
Rubi Fructus	R. nigrobaccus or R. villosus	. . . . . .	Fresh ripe fruit	Eastern and Central United States and Canada
Rubi Idæi Fructus	R. Idæus or R. strigosus	. . . . . .	Fresh ripe fruit	Europe
Rubus	R. cuneifolius, R. villosus, R. nigrobaccus	Blackberry Bark	Bark of rhizome	Eastern and Central United States
Succus Pomorum	Pyrus Malus	. . . . . .	Expressed juice	United States, cult.
Rubiaceæ Coffea Tosta	C. arabica or C. liberica	Roasted Coffee	Dried ripe seeds roasted	Abyssinia and Eastern Africa
Rutaceæ Oleum Aurantii Amari	Citrus Aurantium Amara	. . . . . .	Volatile oil from peel	. . . .
Oleum Aurantii Florum	Citrus Aurantium Amara	Oil of Neroli	Volatile oil from fresh flowers	Italy and Sicily
Oleum Bergamottæ	Citrus Aurantium Bergamia	. . . . . .	Volatile oil from rind of fresh fruit	Italy and Sicily
Succus Citri	Citrus medica acida	. . . . . .	Expressed juice	Florida, cult.
Xanthoxyli Fructus	X. Americanum, X. Clava-Herculis	. . . . . .	Dried fruit	North America
Saccharomycetaceæ Cerevisiæ Fermentum Compressum	Saccharomyces cerevisiæ	. . . . . .	Moist living cells	. . . .
Salicaceæ Populi Gemmæ	Populus nigra or P. balsamifera	Balm of Gilead Buds	Air-dried, closed, winter leaf-buds	United States and Canada
Santalaceæ Santalum Album	Santalum album	White Sandal Wood	Heart wood	Warm countries
Sapotaceæ Gutta Percha	Palaquium (genus)	. . . . . .	Purified coagulated milky exudate	East Indies
Saxifragaceæ Hydrangea	H. arborescens	Seven-barks	Rhizome and roots	Eastern and Central North America
Scrophulariaceæ Leptandra	Veronica virginica	Culver's Root	Rhizome and roots	Eastern and Central United States
Verbasci Flores	V. phlomoides, V. thapsiforme	. . . . . .	Corollas with adhering stamens	United States
Verbasci Folia	V. Thapsus and others	. . . . . .	Dried leaves	United States

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Larkspur Seed	Externally to destroy vermin	Delphinine, delphisine, etc.	*N. F. Prep.*—Tinctura Delphini
Pulsatilla	Diuretic, expectorant; gr. v (0.32 Gm.)	Volatile oil, resin, etc.	*N. F. Prep.*—Tinctura Pulsatilla
Rhamnus Cathartica	Cathartic; gr. xv (1 Gm.)	Rhamnonigrin, emodin, coloring principles	*N. F. Prep.*—Fluidextractum Rhamni Catharticæ, Syrupus Rhamni Catharticæ
Brayera	Tænifuge, anthelmintic; gr. ccxl (15 Gm.)	Cosin, or kosin, resin, volatile oil	*N. F. Prep.*—Infusum Brayeræ
Prune	Laxative, demulcent	Sugar and organic acids	*N. F. Prep.*—Confectio Sennæ
Quillaja	Sternutatory diuretic	Saponin	*N. F. Prep.*—Liquor Picis Carbonis, Tinctura Quillajæ
Blackberries	Tonic, astringent	Malic and citric acids, sugar, tannin, volatile oil	*N. F. Prep.*—Cordiale Rubi Fructus, Elixir Rubi Compositum, Syrupus Rubi Fructus
Raspberries	Laxative	Malic and citric acids, sugar, volatile oil	*N. F. Prep.*—Syrupus Rubi Idæi
Rubus	Tonic, astringent	Tannin and gallic acids, etc.	*N. F. Prep.*—Elixir Rubi Compositum, Fluidextractum Rubi, Syrupus Rubi
Fresh Apple Juice	Tonic, stimulant	Malic acid	*N. F. Prep.*—Extractum Ferri Pomatum
Coffee	Tonic, stimulant, nervine	Caffeine, tannin, etc.	*N. F. Prep.*—Fluidextractum Coffeæ
Oil of Bitter Orange	Adjuvant, flavoring; ♏iii (0.2 mil)	Terpene	*N. F. Prep.*—Elixir Aurantii Amari, Spiritus Odoratus
Oil of Orange Flowers	Adjuvant, flavoring	Geraniol, linalool, limonene	*N. F. Prep.*—Spiritus Odoratus
Oil of Bergamot	Perfume	. . . .	*N. F. Prep.*—Spiritus Odoratus
Lime Juice	Refrigerant	Citric acid	*N. F. Prep.*—Succus Citri et Pepsinum
Prickly Ash Berries	Stimulant, tonic; gr. xv (1 Gm.)	Resins, volatile oil	*N. F. Prep.*—Fluidextractum Stillingiæ Compositum
Compressed Yeast	Tonic, laxative	. . . .	*N. F. Prep.*—Lac Fermentatum
Balsam Poplar Buds	Stimulant, expectorant	Volatile oil, resin	*N. F. Prep.*—Syrupus Pini Strobi Compositus, Syrupus Pini Strobi Compositus cum Morphina
Sandal Wood	Diuretic, perfume	Volatile oil	*N. F. Prep.*—Tinctura Sabal et Santali
Gutta Percha	Protective for wounds	. . . .	*N. F. Prep.*—Liquor Guttæ Perchæ
Hydrangea	Diuretic, narcotic; gr. xxx (2 Gm.)	Hydrangin	*N.F.Prep.*—Fluidextractum Hydrangeæ
Leptandra	Cathartic, cholagogue; gr. xv (1 Gm.)	Leptandrin, saponin, etc.	*N. F. Prep.*—Extractum Leptandræ, Fluidextractum Leptandræ, Pilulæ Catharticæ Vegetabiles
Mullein Flowers	Demulcent, expectorant; ʒii (8 Gm.)	Volatile oil, resin	*N. F. Prep.*—Species Pectorales
Mullein Leaves	Demulcent, expectorant; gr. xv (1 Gm.)	Volatile oil, resin	*N. F. Prep.*—Fluidextractum Verbasci Foliæ

Family and Official Name	Botanical Name	Synonym	Part used, or Description	Habitat
Solanaceæ				
Dulcamara	Solanum D.	. . . . . .	Stem and branches	Europe and Asia
Solanum	S. Carolinense	Horse-nettle Berries	Ripe fruit	Canada and United States
Sterculiaceæ				
Cacao Praeparatum	Theobroma Cacao and others	Prepared Cacao	Powder from roasted, cured kernels of ripe seeds	Countries on the Gulf of Mexico
Kola	Several species of Cola	Cola	Dried cotyledons	Guinea
Turneraceæ				
Damiana	Turnera diffusa or T. aphrodisiaca	Turnera	Leaves	Tropical America
Umbelliferæ				
Angelicæ Fructus	A. Archangelica and others	Angelica Seed	Ripe fruit	Southern Europe
Angelicæ Radix	A. atropurpurea and others	. . . . . .	Rhizome and roots	Northern United States and Canada
Apii Fructus	Apium graveolens	Celery Seed	Ripe fruit	Cultivated
Conium	C. maculatum	Poison Hemlock	Full grown but unripe fruit	Europe
Petroselini Radix	Petroselinum sativum	. . . . . .	Root	Southern Europe, Asia Minor
Pimpinella	P. Saxifraga or P. magna	Pimpernel Root	Rhizome and roots	Asia Minor, Europe
Verbenaceæ				
Verbena	V. hastata	Blue Vervain	Overground portion	North America
Zingiberaceæ				
Galangal	Alpinia officinarum	. . . . . .	Rhizome	East Indies
Oleum Cardamomi	Elettaria Cardamomum	. . . . . .	Volatile oil from seeds	Farther India
Zedoaria	Curcuma Z.	. . . . . .	Rhizome	East Indies
Zygophyllaceæ				
Guaiaci Lignum	G. officinale or G. sanctum	Lignum Vitæ	Heart-wood	Warm tropical regions

English Name	Medical Properties, Dose	Principal Constituents	Official Preparations
Bittersweet	Diuretic, sedative; gr. lx (4 Gm.)	Dulcamarin, solanine	*N. F. Prep.*—Fluidextractum Dulcamaræ
Solanum	Nerve tonic, antispasmodic; gr. lx (4 Gm.)	Solanine, solanidine	*N. F. Prep.*—Fluidextractum Solani
Cocoa	Flavoring	Starch	*N. F. Prep.*—Trochisci Quininæ Tannatis, Trochisci Santonini, Trochisci Santonini Compositi
Kola	Stimulant, nervine; gr. lx (4 Gm.)	Caffeine, theobromine	*N. F. Prep.*—Fluidextractum Kolæ
Damiana	Stimulant, aphrodisiac; gr. xxx (2 Gm.)	Damianin, volatile oil, etc.	*N. F. Prep.*—Fluidextractum Damianæ
Angelica Fruit	Stimulating expectorant; gr. xv (1 Gm.)	Volatile oil	*N. F. Prep.*—Pilulæ Antiperiodicæ, Pilulæ Antiperiodicæ sine Aloe, Tinctura Antiperiodica, Tinctura Antiperiodica sine Aloe
Angelica Root	Expectorant, emmenagogue; gr. xxx (2 Gm.)	Volatile oil	*N. F. Prep.*—Fluidextractum Angelicæ Radicis
Celery Fruit	Stimulant, antispasmodic; gr. xxx (2 Gm.)	Volatile oil, apiol	*N. F. Prep.*—Fluidextractum Apii Fructus
Conium	Sedative, narcotic; gr. iii (0.2 Gm.)	Coniine, conhydrine, pseudoconhydrine	*N. F. Prep.*—Extractum Conii, Fluidextractum Conii
Parsley Root	Emmenagogue, antiperiodic; gr. xxx (2 Gm.)	Volatile oil containing apiol	*N. F. Prep.*—Fluidextractum Petroselini Radicis
Pimpinella	Tonic, carminative; gr. xv (1 Gm.)	Volatile oil, resin	*N. F. Prep.*—Tinctura Pimpinellæ
Verbena	Antiperiodic; gr. xv (1 Gm.)	. . . .	*N. F. Prep.*—Fluidextractum Verbenæ
Galanga	Carminative, aromatic stimulant; gr. xv (1 Gm.)	Galangol, volatile oil, cineol	*N. F. Prep.*—Tinctura Aromatica
Oil of Cardamon	Flavor	. . . .	*N. F. Prep.*—Elixir Cardamomi Compositum, Elixir Vanillini Compositum, Spiritus Cardamomi Compositus, Spiritus Vanillini Compositus
Zedoary	Aromatic, carminative; gr. xv (1 Gm.)	Volatile oil	*N. F. Prep.*—Pilulæ Antiperiodicæ, Pilulæ Antiperiodicæ sine Aloe, Tinctura Amara, Tinctura Antiperiodica, Tinctura Antiperiodica sine Aloe, Tinctura Zedoariæ Amara
Guaiac Wood	Antirheumatic; gr. lx (4 Gm.)	Resin	*N. F. Prep.*—Decoctum Sarsaparilla Compositum

CHAPTER LXI

PRODUCTS FROM ANIMAL SUBSTANCES

THE animal products of pharmaceutical interest are not numerous, but some of them are very important.

Protein substances, or, as formerly called, *proteids,* are any one of a group of complex substances forming the essential constituents of living cells and from which all animal and vegetable tissues are built up. They are combinations of amino acids or their derivatives and all contain carbon, hydrogen, oxygen, and nitrogen. Sulphur also occurs in most of the groups, and phosphorus and iron in a few. They are mostly colloidal, are insoluble in ether or alcohol, are coagulated by heat, and may be decomposed by mineral acids, caustic alkalies, proteolytic enzymes and putrefying bacteria, the ultimate product being an amino acid.

Simple proteins, or those yielding only amino acids on hydrolysis, are represented by *albumins, globulins, glutelins, albuminoids, histons,* and *protamins. Conjugated proteins,* those combining some other molecule, but not as a salt, are represented by *nucleo-proteins, glycoproteins, phosphoproteins, nucleo-albumins, hemoglobins, lecithoproteins.*

Derived proteins, resulting from hydrolytic change, are represented by *proteins, metaproteins, proteoses, peptones,* and *peptids.*

Ptomaines or cadaveric alkaloids are produced when animal substances are subjected to putrefaction or fermentative processes. Many of them are intensely poisonous. They have an alkaline reaction, forming salts like the alkaloids, and may be volatile or fixed, fluid or solid, crystalline or amorphous. Some ptomaines are tasteless and odorless, others have an intensely bitter taste and an aromatic odor. The alkaloids from animal excretions have been given the name of *leucomaines;* nitrogenous poisonous substances derived from animal tissues which are not alkaloids are termed *toxalbumins.*

Serums and vaccines have become important agents in the modern treatment of disease, and these will be discussed in the following pages.

The animal products of interest in pharmacy are grouped according to the *class* to which they belong, as follows: 1. Mammalia. 2. Pisces. 3. Aves. 4. Insecta. 5. Reptilia. 6. Annelida. There are no official products from the third, fifth, or sixth classes.

Official Products Derived from the Class Mammalia

ADEPS. U. S. Lard

The purified internal fat of the abdomen of the hog (*Sus scrofa,* var. *domesticus* Gray, Fam. *Suidæ*). Preserve it in a cool place in well-closed containers which are impervious to fat.

Preparation.—The adipose matter adhering to the kidneys, mesentery, and omentum of the hog is the usual source of the best lard. This, after careful removal of the membranes and adhering flesh, should be cut into small pieces, malaxated with successive portions of cold water until this remains clear, and then heated *moderately,* in a tinned iron or copper vessel, over a *slow* fire, until the melted fat becomes perfectly clear and anhydrous. Lastly, it is to be strained into earthen pots, being occasionally stirred as it cools; the pots should be securely covered with waxed or varnished paper, or the lard protected from the air by pouring over it a thin layer of melted paraffin, and kept in a cool, dry cellar.

The purification of lard, by which the "odor of the pig" is separated, is attended with considerable labor. In France this is an industry by itself, large quantities of purified lard being used in making pomades (see page 1113). The process usually consists in spreading the lard, which has been heated with a little powdered alum, strained, and cooled, upon an inclined slate or marble slab so arranged that a stream of water can trickle on it. While the water is running, the lard is thoroughly worked with a spatula, stirrer, or muller, so that a fresh surface is continually exposed to the action of the water. This tedious process is continued until the lard is *completely washed and deodorized.*

Official Description.—A soft, white, unctuous solid; it is free from rancidity.

Odor and Taste.—A faint odor and a bland taste.

Solubility.—Insoluble in water; very slightly soluble in alcohol; readily soluble in ether, chloroform, carbon disulphide, or petroleum benzin.

Test for Identity.—Lard melts between 36° and 42° C. (96.8°–107.6° F.) to a clear liquid, from which no aqueous layer separates.

Impurities and Tests for Impurities.—*Alkalies.*—Distilled water boiled with Lard does not acquire an alkaline reaction.

Chlorides.—Boil about 1 Gm. of Lard with 20 mils of alcohol and filter the solution after cooling; the filtrate is not rendered more than slightly turbid by the addition of a few drops of a saturated alcoholic solution of silver nitrate.

Free Fatty Acids.—Dissolve 10 Gm. of Lard in 30 mils of chloroform, mix the solution with 10 mils of neutral alcohol and add 1 drop of phenolphthalein T.S.; not more than 2 mils of tenth-normal potassium hydroxide V.S. is required to produce a pink tint after shaking it vigorously.

Cottonseed Fats.—Intimately mix 5 mils of melted and filtered Lard, while warm, by agitating it in a test tube with 5 mils of an alcoholic solution of silver nitrate (made by dissolving 0.1 Gm. of silver nitrate in 10 mils of alcohol, and adding 2 drops of nitric acid); heat this mixture for five minutes on a water bath. The liquid fat acquires no reddish or brown color, nor is any dark color produced at the line of contact of the hot liquids.

Beef Stearin.—Dissolve 5 Gm. of Lard in 20 mils of ether in a test tube, stopper the tube loosely with purified cotton and allow it to stand for about twelve hours or over night at a temperature of about 20° C. (68° F.). Collect some of the crystals which have separated at the bottom of the test tube, mount them in either alcohol or a fixed oil and examine them under a microscope having a magnifying power of about two hundred diameters. Lard stearin crystallizes in the form of flat and rhomboidal plates, cut off obliquely at one end and grouped irregularly. Beef stearin crystallizes in the form of cylindrical rods or needles with sharp ends, grouped in fan-shaped clusters.

Saponification Value.—Not less than 195 nor more than 203 (see U. S. P., Test No. 9, Chapter LXII).

Iodine Value.—Not less than 46 nor more than 70 (see U. S. P., Test No. 8, Chapter LXII).

U. S. P. Preparations.—Adeps Benzoinatus; Ceratum Resinæ; Emplastrum Plumbi; Linimentum Terebinthinæ (from Rosin Cerate); Unguentum Hydrargyri Nitratis; Unguentum Picis Liquidæ.

N. F. Preparations.—Unguentum Camphoræ; Unguentum Picis Compositum; Unguentum Sulphuris Compositum.

Lard, like most animal fats and oils, consists of stearin, palmitin, and olein, its consistence, when pure, depending largely upon the relative proportion of these principles; olein, being the liquid principle, can readily be separated from the other two by subjecting lard in cold weather to strong pressure, when the *olein* (*lard oil*) is pressed out, the solid residue (*stearin*) being used for various purposes, particularly for the manufacture of candles.

Lard Oil (U. S. P. VIII) is a fixed oil, consisting principally of olein, and made by exposing lard to a low temperature and then pressing it powerfully in an hydraulic press. As found in commerce, it is almost *invariably adulterated with paraffin oil.* As it is largely employed as a lubricating oil, this admixture is not particularly injurious, but if it is to be used as a vehicle for citrine ointment, as in the U. S. P. 1890, the presence of paraffin oil prevents solidification. (For description and tests, see the U. S. P. VIII.)

Uses.—Lard is used in pharmacy principally as a vehicle for ointments; it needs protection from rancidity, however. (See Adeps Benzoinatus.)

ADEPS BENZOINATUS. U. S. Benzoinated Lard

[Adeps Benz.]

	Metric	Old form
***Lard**	1000 Gm.	16 oz. av.
Siam Benzoin, in coarse powder	10 Gm.	70 grains
To make about	1000 Gm.	16 oz. av.

Add the benzoin to the lard and mix thoroughly; then melt the mixture by means of a water bath, and, stirring frequently, continue the heat for two hours, covering the vessel and not allowing the temperature to rise above 60° C. (140° F.). Lastly, strain the liquid through muslin, and stir it occasionally, while it cools. Preserve it in a cool place in well-closed containers which are impervious to fat.

For use in southern latitudes and during the heated season in other localities, 50 Gm. [or 750 grains] of the lard (or more, if necessary) may be replaced by an equal weight of white wax.

U. S. P. Preparations.—Ceratum; Ceratum Cantharidis; Unguentum; Unguentum Belladonnæ; Unguentum Chrysarobini; Unguentum Hydrargyri; Unguentum Iodi; Unguentum Iodoformi; Unguentum Stramonii; Unguentum Sulphuris; Unguentum Zinci Oxidi.

N. F. Preparations.—Ceratum Camphoræ; Mulla Hydrargyri Chloridi Corrosivi; Mulla Acidi Salicylici; Mulla Zinci; Pasta Zinci Sulphurata; Unguentum Plumbi Iodidi; Unguentum Potassii Iodidi; Unguentum Sulphuris Alkalinum; Unguentum Veratrinæ.

Certain balsamic substances, when digested with lard or fats, have the property of preventing or retarding rancidity; benzoin is most frequently used for this purpose. The temperature at which it is digested should not exceed 60° C. (140° F.), or the agreeable vanilla-like odor of the benzoin will be dissipated. A specially selected benzoin, called Siam benzoin or vanilla-benzoin, is preferably used, and is now directed by the Pharmacopœia, and small amounts of vanillin have sometimes been added to increase the delicacy of the odor. The method of adding tincture of benzoin to cold lard does not produce a good product, for it is darker in color, less fragrant, and sometimes acts as an irritant when applied in certain skin diseases.

ADEPS LANÆ. U. S. Wool Fat

[**Adeps Lan.**—ANHYDROUS LANOLIN]

The purified fat of the wool of the sheep (*Ovis aries* Linné, Fam. *Bovidæ*), freed from water. Preserve it in a cool place in well-closed containers which are impervious to fat.

Preparation.—This substance, to which the name of *anhydrous lanolin* is applied, is prepared by purifying the fatty matter obtained from the wool of the sheep (*suint*). This natural wool fat contains about 30 per cent. of free fat acids and fatty acid esters of *cholesterin* and other alcohols. The cholesterin compounds are the important constituents and, to secure these in a purified form, many processes have been devised. In one of these the crude wool fat is treated with weak alkali, the saponified fats, and emulsion, centrifuged to secure the aqueous soap solution, from which, on standing, a layer of partially purified wool fat separates. This product is further purified by treating it with calcium chloride and then dehydrating by fusion with unslaked lime. It is finally extracted with acetone and the solvent subsequently separated by distillation. *Wool fat* differs from *hydrous wool fat* in containing practically no water. Wool fat consists mainly of *cholesterin* and *isocholesterin,* $C_{26}H_{43}OH$, but other alcohols are present, associated with esters.

Official Description.—A light yellow, tenacious, unctuous mass.

Odor.—It has not more than a slight odor.

Solubility.—It is insoluble in, but miscible with, about twice its weight of water, sparingly soluble in cold alcohol, more soluble in hot alcohol, freely soluble in ether and in chloroform.

Tests for Identity.—Wool Fat melts between 38° and 42° C. (100.4° and 107.6° F.). At higher temperatures it vaporizes, the vapor igniting and burning with a luminous, sooty flame.

A solution of Wool Fat in chloroform (1 in 50), when poured upon the surface of concentrated sulphuric acid, gradually develops a deep brownish-red color at the line of contact of the layers.

Impurities and Tests for Impurities.—*Water.*—Dried to a constant weight on a water bath, with frequent stirring, Wool Fat loses not more than 0.5 per cent. of its weight.

Alkalies and Soaps.—Incinerate about 1 Gm. of Wool Fat; not more than 0.1 per cent. of ash remains. The ash, if any, is not alkaline to moistened litmus paper.

Free Alkalies.—Dissolve about 2 Gm. of Wool Fat in 10 mils of ether and add 2 drops of phenolphthalein T.S.; a colorless liquid is obtained which,

Free Fatty Acids.—on the addition of 0.2 mil of tenth-normal potassium hydroxide V.S., develops a deep red color.

Chlorides.—Boil about 1 Gm. of Wool Fat with 20 mils of alcohol, and filter the solution after cooling; the filtrate is not rendered more than slightly turbid by the addition of a few drops of saturated alcoholic solution of silver nitrate.

Glycerin.—Melt about 10 Gm. of Wool Fat with 50 mils of distilled water on a water bath with constant stirring; the fat separates completely on cooling, leaving the aqueous layer nearly clear and neutral to litmus. Separate portions of 10 mils each of the filtered aqueous layer leave no sweet residue on evaporation,

Soluble Oxidizable Impurities.—emit no ammonia vapors when boiled with 1 mil of potassium hydroxide T.S., and do not completely decolorize 0.05 mil of tenth-normal potassium permanganate V.S. within ten minutes.

Petrolatum.—About 0.5 Gm. of Wool Fat dissolves completely in 40 mils of boiling dehydrated alcohol.

Iodine Value.—Not less than 18 nor more than 28 (U. S. P., Test No. 8, Chapter LXII).

N. F. Preparations.—Ceratum Plumbi Subacetatis; Unguentum Resorcinolis Compositum.

Uses.—Wool fat is used as a vehicle for ointments, but the hydrous wool fat is more frequently employed.

ADEPS LANÆ HYDROSUS. U. S. Hydrous Wool Fat

[Adeps Lan. Hyd.—LANOLIN]

The purified fat of the wool of the sheep (*Ovis aries* Linné, Fam. *Bovidæ*), combined with not less than 25 nor more than 30 per cent. of water. Preserve it in a cool place in well-closed containers which are impervious to fat.

Preparation.—Hydrous wool fat is made by incorporating about 30 per cent. of water with anhydrous wool fat.

Official Description.—A yellowish white, or nearly white, ointment-like mass.

Odor.—It has not more than a slight odor.

Solubility.—It is insoluble in water; with ether or chloroform it yields turbid solutions which are neutral to moistened litmus paper.

Tests for Identity.—Hydrous Wool Fat on heating separates into an upper oily and a lower aqueous layer. When heated on a water bath with stirring until it ceases to lose weight, there remains not less than 70 per cent. and not more than 75 per cent. of residue, which is transparent when melted, and when cold remains as a yellowish, tenacious, unctuous mass, completely soluble in ether or chloroform, and only sparingly soluble in alcohol.

Tests for Impurities.—Hydrous Wool Fat thus deprived of water responds to the tests under *Adeps Lanæ*.

U. S. P. Preparations.—Unguentum Belladonnæ; Unguentum Hydrargyri Ammoniati; Unguentum Hydrargyri Oxidi Flavi; Unguentum Stramonii.

N. F. Preparations.—Inunctum Mentholis; Unguentum Mentholis Compositum; Petroxolinum Hydrargyri; Unguentum Hydrargyri Oxidi Rubri.

Uses.—This substance is used largely as a vehicle for ointments, for which it is admirably adapted, on account of the facility with which it is absorbed by the skin.

SEVUM PRÆPARATUM. U. S. Prepared Suet

[Sev. Præp.—MUTTON SUET]

The internal fat of the abdomen of the sheep (*Ovis aries* Linné, Fam. *Bovidæ*), purified by melting and straining. Preserve Prepared Suet in well-closed vessels impervious to fat. It must not be used after it has become rancid.

Preparation.—Prepared Suet is made by a process similar to that for lard. (See Adeps.)

Official Description.—A white, solid fat, becoming rancid on prolonged exposure to the air.

Odor, Taste, and Reaction.—Nearly inodorous and having a bland taste when fresh. An alcoholic solution of Prepared Suet is neutral or slightly acid to litmus paper moistened with alcohol.

Solubility.—It is insoluble in water or cold alcohol; dissolves in 44 parts of boiling alcohol, in about 60 parts of ether, and slowly dissolves in two parts of purified petroleum benzin. From its solution in the latter, when allowed to stand in a stoppered flask, it slowly separates in a crystalline form.

Tests for Identity.—Prepared Suet melts between 45° and 50° C. (113° and 122° F.) and congeals between 37° and 40° C. (98.6° and 104° F.).

Impurities and Tests for Impurities.—*Free Acid.*—One Gm. of Prepared Suet, dissolved in 50 mils of hot alcohol, and a few drops of phenolphthalein T.S. added, requires not more than 0.6 mil of tenth-normal potassium hydroxide V.S. to produce a pink color.

Saponification Value.—Not less than 193 nor more than 200 (U. S. P., Test No. 9, Chapter LXII).

Iodine Value.—Not less than 33 nor more than 48 (U. S. P., Test No. 8, Chapter LXII).

U. S. P. Preparation.—Unguentum Hydrargyri.

N. F. Preparations.—Ceratum Resinæ Compositum; Sevum Benzoinatum; Unguentum Fuscum.

Uses.—Prepared suet is used in ointments and cerates and is firmer than lard, owing to its containing a larger proportion of stearin.

SEVUM BENZOINATUM. N. F. Benzoinated Suet

[Sev. Benz.]

	Metric	Old form
Benzoin, in No. 40 Powder	30 Gm.	210 gr.
Prepared Suet	1000 Gm.	16 oz. av.
To make about	1000 Gm.	16 oz. av.

Mix the benzoin thoroughly with the suet and allow the mixture to stand at the room temperature for two hours, then melt it on a water bath and maintain a temperature not exceeding 50° C. (122° F.) during one hour, stirring frequently; finally strain, and stir the mixture until cold. This form of suet is less likely to become rancid than the ordinary suet.

GELATINUM. U. S. Gelatin

[Gelat.]

The purified product obtained from animal tissues, as skin, ligaments, and bones, by treatment with boiling water.

Preparation.—Gelatin is made by boiling carefully selected animal material (usually fresh bones) with water until the collagen is rendered soluble and the solution stiffens to a jelly on cooling. While hot, the fat and other foreign matter are skimmed from the surface, the liquid clarified, filtered, and cooled and the jelly cut into slices which are dried on nets. These sheets may be cut into thin pieces to form *shred gelatin* or ground to form *powdered* or *ground gelatin*. When less carefully selected material is taken, such as hoofs, horns, animal skin, etc., the product is termed *glue*.

Official Description.—An amorphous solid, in sheets or flakes or in ground, powdered or shredded form, colorless or slightly yellowish. Unalterable in the air when dry, but decomposing when moist or in solution.

Odor and Taste.—A very slight, characteristic odor and taste.

Solubility.—Gelatin is insoluble in cold water but swells and softens when immersed in it, gradually absorbing from 5 to 10 times its own weight of water; soluble in hot water, acetic acid or glycerin; insoluble in alcohol, chloroform, ether, benzene, carbon disulphide or fixed or volatile oils.

Tests for Identity.—An aqueous solution of Gelatin (1 in 5000) is at once rendered turbid by the addition of tannic acid T.S.

A hot solution of Gelatin in distilled water (1 in 40) is free from putrid odor, and is not more than slightly acid to litmus; it appears not more than slighty opalescent in a stratum 2 cm. in thickness, and, on cooling to 6° C. (42.8° F.) and standing for several hours, it forms a firm, transparent or translucent jelly.

Impurities and Tests for Impurities.—*Heavy Metals.*—Incinerate about 0.5 Gm. of Gelatin; not more than 2 per cent. of ash remains. A solution of the ash in 25 mils of distilled water, made with the aid of heat and a few drops of hydrochloric acid, does not respond to the Test for heavy metals (U. S. P., Test No. 3, Chapter LXII).

Arsenic.—Heat 1.5 Gm. of Gelatin with 30 mils of hydrochloric acid (1 in 4) in a 150 mil Erlenmeyer flask on a water bath, and when the Gelatin has dissolved, add 3 mils of saturated bromine water and heat it on a water bath for fifteen minutes, shaking the flask occasionally. Then add 0.5 Gm. of potassium iodide and follow it immediately with 0.5 mil of 25 per cent. solution of stannous chloride. Heat the solution for five minutes on a water bath, cool and subject it to the Test for arsenic (U. S. P., Test No. 1, Chapter LXII). The stain produced, if any, is not greater than that produced in a test made with the same quantities of the reagents to which 2 mils of the standard arsenic test solution (U. S. P., Test No. 1, Chap. LXII) has been added.

Dissolve 20 Gm. of Gelatin in 150 mils of hot distilled water in a flask having a round bottom and a long neck, add 5 mils of phosphoric acid and 1 Gm. of sodium bicarbonate, and at once connect the flask with a condenser. Distil 50 mils, receiving the distillate under the surface of 50 mils of tenth-normal iodine V.S. Acidulate the distillate with a few drops of hydrochloric acid, add 2 mils of barium chloride T.S., and heat on a water bath until the liquid is nearly colorless. The precipitate of barium sulphate, if any, when filtered, washed and ignited, weighs not more than 0.0015 Gm., corresponding to not more than 0.002 per cent. of *sulphur dioxide* in the Gelatin, correction being made for any sulphate which may be present in 50 mils of the tenth-normal iodine V.S.

NOTE.—Gelatin used for making capsules for medicines contains not more than 0.15 per cent. of sulphur dioxide.

U. S. P. Preparation.—Gelatinum Glycerinatum.

Uses.—Gelatin is largely used in pharmacy to coat pills and form capsules, and as a vehicle for suppositories.

PEPSINUM. U. S. Pepsin

[Pepsin.]

A mixture containing a proteolytic ferment or enzyme, obtained from the glandular layer of the fresh stomach of the hog (*Sus scrofa,* var. *domesticus* Gray) (Fam. *Suidæ*). It digests not less than 3000 times its own weight of freshly coagulated and disintegrated egg albumen. Pepsin of a higher digestive power may be brought to this standard by admixture with pepsin of a lower digestive strength or with sugar of milk. Preserve it in well-closed containers.

Preparation.—Pepsin is yet largely made by the following process of Prof. Scheffer. The mucous membrane of hogs' stomachs is macerated in water, acidulated with hydrochloric acid for several days, with frequent stirring. The strained liquid, if not clear, is clarified by allowing it to stand for twenty-four hours, and decanting. Sodium chloride is then thoroughly mixed with it. After several hours the floating pepsin is skimmed from the surface and put on a cotton cloth to drain, and finally is submitted to strong pressure to get rid of the saline solution. This pepsin, when air-dried, is very tough, parchment-like or leathery, varying in color from a dim straw-yellow to a brownish-yellow. *Purified pepsin,* or *scale pepsin,* is made by subjecting the well-cleaned mucous membrane to a process of self-digestion, in acidified water at about 40° C. (104° F.), until a transparent, glairy fluid results. This is preserved with chloroform, strained, concentrated in vacuum and scaled on glass plates. It is in the form of yellowish scales. It is sometimes prepared in smaller scales and called *granular pepsin.* When in this scaled form pepsin is very soluble, and analysis has shown the presence of as much as 12 to 14 per cent. of free hydrochloric acid. One of the newer forms of commercial pepsin is the "*spongy*" variety, said to be produced by drying the pepsin solution in vacuum driers which causes the pepsin to puff and assume a spongy form.

An insoluble pepsin freed from acid is also largely used for dispensing in powders and capsules; as it is not hygroscopic, it can be dispensed without becoming moist.

Official Description.—Pepsin occurs in lustrous, white, pale yellow or yellowish, transparent or translucent scales, grains or spongy masses, or as a fine, white or cream-colored, amorphous powder. It is not more than slightly hygroscopic.

Odor, Taste, and Reaction.—Free from any offensive odor, and having a slightly acid or saline taste. An aqueous solution of Pepsin (1 in 50) is acid to litmus.

Solubility.—One Gm. of Pepsin dissolves in about 50 parts of water, the solution being more or less opalescent; nearly insoluble in alcohol, chloroform or ether.

Tests for Identity.—When in solution, Pepsin is incompatible with alkalies, alkali earths, or alkali carbonates. The presence of hydrochloric acid of greater strength than 0.5 per cent. in Pepsin solutions inhibits its proteolytic activity. A precipitate is produced in its solution by the salts of many heavy metals, and by tannic acid or gallic acid.

A saturated solution of Pepsin in acidulated water when heated to 100° C. (212° F.) becomes milky, or yields a light, flocculent precipitate, and loses all proteolytic power. In a dry state it is not injured if subjected to the above temperatures. The activity of Pepsin in solution is destroyed by temperatures exceeding 70° C. (158° F.).

Assay.—Mix 25 mils of normal hydrochloric acid V.S. with 275 mils of distilled water and dissolve 0.1 Gm. of Pepsin in 150 mils of this liquid. Immerse a hen's egg, which is not less than five nor more than twelve days old and has been kept in a cool place, in boiling water during fifteen minutes. As soon as the egg has sufficiently cooled to handle it, remove the pellicle and all of the yolk; at once rub the albumen through a clean, dry, hair or brass, No. 40 sieve, reject the first portion that passes through the sieve, and place 10 Gm. of the succeeding portion in a wide-mouthed bottle of 100 mils capacity. Immediately add 2 mils of the acid liquid and, with the aid of a rubber-tipped glass rod, moisten the albumen uniformly. Again add 2 mils of the acid liquid, repeat the manipulation with the glass rod, and with gradually increasing portions of the acid liquid, until the total amount added measures 20 mils. Thoroughly separate the particles of albumen from each other, rinse the rod with 15 mils more of the acid liquid, and, after warming the mixture to 52° C. (125.6° F.), add exactly 5 mils of the solution of Pepsin. At once cork the bottle securely, invert it three times, and place it on a water bath that has previously been regulated to maintain a temperature of 52° C. (125.6° F.). Keep it at this temperature for two and one-half hours, agitating the contents every ten minutes by inverting the bottle once. Then remove it from the water bath, pour the contents into a conical measure having a diameter not exceeding 1 cm. at the bottom, and transfer the undigested egg albumen which adheres to the sides of the bottle to the measure with the aid of small portions (about 15 mils at a time) of distilled water, until the total amount used measures 50 mils. Stir the mixture well and let it stand for half an hour; the deposit of undissolved albumen does not then measure more than 1 mil.

The relative proteolytic power of Pepsin, stronger or weaker than that just described, may be determined by ascertaining through repeated trials the quantity of the Pepsin solution, made as directed in the assay, required to digest, under the prescribed conditions, 10 Gm. of boiled and disintegrated egg albumen. Divide 15,000 by this quantity expressed in mils to ascertain how many parts of egg albumen one part of Pepsin will digest.

N. F. Preparations.—Elixir Cinchonæ Alkaloidorum; Ferri et Pepsini; Elixir Pepsini (from Glycerite); Elixir Pepsini, Bismuthi et Strychninæ; Elixir Pepsini et Bismuthi; Elixir Pepsini et Ferri; Elixir Pepsini et Rennini Compositum; Glyceritum Pepsini; Liquor Ferri Peptonati; Liquor Ferri Peptonati et Mangani; Liquor Pepsini (from Glycerite); Liquor Pepsini Antisepticus; Liquor Pepsini Aromaticus; Pepsinum Saccharatum; Succus Citri et Pepsini (from Glycerite); Vinum Pepsini (from Glycerite).

Uses.—Pepsin is used to aid the digestion of food, and is given in dyspepsia, in doses of three to thirty grains (0.2 to 2 Gm.). Pepsin is not active in the presence of alkalies and is ultimately decomposed by them and also by bismuth subcarbonate and subnitrate.

PEPSINUM SACCHARATUM. N. F. Saccharated Pepsin

[Pepsin. Sacchar.]

	Metric	Old form
Pepsin....................................	**10 Gm.**	175 gr.
Sugar of Milk, recently dried and in fine powder....	**90 Gm.**	3 oz. av. 262 gr.
To make..............................	**100 Gm.**	4 oz. av.

Triturate the pepsin with the sugar of milk to a uniform, fine powder. Keep the product in well-stoppered bottles. The dose is fifteen grains (1 Gm.).

LIQUOR PEPSINI. N. F. Solution of Pepsin

[Liq. Pepsin.]

	Metric	Old form
Glycerite of Pepsin	**50 mils**	1 fl. oz. 288 min.
Hydrochloric Acid	**10 mils**	154 min.
Glycerin	**315 mils**	10 fl. oz. 38 min.
Distilled Water, a sufficient quantity,		
To make	**1000 mils**	2 pints

Mix the glycerite of pepsin, acid, and glycerin and add sufficient distilled water to make the product measure 1000 mils [old form 2 pints]. Mix well, allow it to stand two days, then filter. The dose is two fluidrachms (8 mils).

LIQUOR PEPSINI ANTISEPTICUS. N. F. Antiseptic Solution of Pepsin

[Liq. Pepsin. Antisept.]

	Metric	Old form
Pepsin	**50.0 Gm.**	1 oz. av. 263 gr.
Menthol	**0.5 Gm.**	7 gr.
Eucalyptol	**0.5 mil**	8 min.
Methyl Salicylate	**0.5 mil**	8 min.
Alcohol	**10.0 mils**	154 min.
Glycerin	**50.0 mils**	1 fl. oz. 288 min.
Diluted Hydrochloric Acid	**20.08 mils**	308 min.
Purified Talc	**20.0 Gm.**	280 gr.
Distilled Water, a sufficient quantity,		
To make	**1000 mils**	2 pints

Dissolve the pepsin, the diluted hydrochloric acid and glycerin in 800 mils [old form 25 fluidounces 288 minims] of distilled water. Then dissolve the menthol, eucalyptol, and methyl salicylate in the alcohol, mix this liquid with the pepsin solution and add sufficient distilled water to make the product measure 1000 mils [old form 2 pints]. Finally mix the purified talc with the solution and filter, returning the first portion of the filtrate until the liquid passes through clear.

Uses.—This solution is used as a dressing for old wounds, causing the digestion of extraneous tissue and promoting healing. It is not used internally.

LIQUOR PEPSINI AROMATICUS. N. F. Aromatic Solution of Pepsin

[Liq. Pepsin. Arom.]

	Metric	Old form
Pepsin	**17.50 Gm.**	255 gr.
Oil of Cinnamon	**0.25 mil**	4 min.
Oil of Pimenta	**0.25 mil**	4 min.
Oil of Clove	**0.50 mil**	8 min.
Purified Talc	**15.00 Gm.**	210 gr.
Alcohol	**35.00 mils**	1 fl. oz. 58 min.
Hydrochloric Acid	**10.00 mils**	154 min.
Glycerin	**250.00 mils**	8 fl. oz.
Distilled Water, a sufficient quantity,		
To make	**1000 mils**	2 pints

Dissolve the pepsin and the hydrochloric acid in 500 mils [old form 1 pint] of distilled water. Then add the oils, previously dissolved in the alcohol, the glycerin and sufficient distilled water to make the product measure 1000 mils [old form 2 pints]. Add the purified talc and filter, returning the first portions of the filtrate until it passes through clear.

Uses.—It is used as a digestant; the dose is two fluidrachms (8 mils).

SUCCUS CITRI ET PEPSINUM. N. F. Lime Juice and Pepsin

[**Suc. Cit. et Pepsin.**—Succus Limettæ cum Pepsino, N. F. III]

	Metric	Old form
Glycerite of Pepsin	**400 mils**	12 fl. oz. 384 min.
Lime Juice	**600 mils**	19 fl. oz. 96 min.
To make	**1000 mils**	2 pints

Add the glycerite of pepsin to the lime juice and filter the mixture. This preparation should not be dispensed unless it has been recently prepared.

Uses.—It is a pleasantly flavored digestant; dose, two fluidrachms (8 mils).

PANCREATINUM. U. S. Pancreatin

[Pancreat.]

It contains enzymes, consisting principally of amylopsin, trypsin, and steapsin, found in the pancreas of warm-blooded animals, and obtained from the fresh pancreas of the hog (*Sus scrofa* var. *domesticus* Gray) (Fam. *Suidæ*), or of the ox (*Bos taurus* Linné) (Fam. *Bovidæ*). It converts not less than 25 times its own weight of starch into soluble carbohydrates when assayed as directed on page 1448. Pancreatin of a higher digestive power may be brought to this standard by admixture with sugar of milk. Preserve it in well-closed containers.

Preparation.—Pancreatin is made by cutting the fresh pancreas into small pieces, kneading thoroughly with water, straining the liquid, and then filtering; an equal volume of alcohol is added to the filtrate and the precipitate is dried and powdered. The constituent *amylopsin* converts starch into maltose and forms small amounts of dextrose. Slight acidity checks this reaction and destroys the enzyme. *Trypsin* acts upon proteins and nucleoproteins, changing them into peptones and polypeptids. An excess of mineral acid soon decomposes it, although it keeps fairly well in 25 to 50 per cent. alcohol and best in 50 per cent. glycerin. Both ferments are most active at 40° C. (104° F.), in a slightly alkaline medium.

Official Description.—Pancreatin is a cream-colored, amorphous powder.

Odor.—Having a faint, characteristic, but not offensive, odor.

Solubility.—It is slowly and incompletely soluble in water; insoluble in alcohol.

Tests for Identity.—Pancreatin changes proteins into proteoses and derived substances, and converts starch into dextrins and sugars. Its peculiar activities are best exhibited in neutral or faintly alkaline media; more than traces of mineral acids or large amounts of alkali hydroxides render it inert. An excess of alkali carbonates also inhibits its action.

Impurities and Tests for Impurities.—*Fat.*—Introduce 2 Gm. of Pancreatin into a flask of about 50 mils capacity, add 20 mils of ether, stopper and set it aside for several hours, shaking by rotating at frequent intervals. Decant the supernatant ether, by means of a guiding rod, into a plain filter of about 7 cm. diameter, previously moistened with ether, and collect the filtrate in a tared beaker. To the residue remaining in the flask add a further portion of 10 mils of ether, proceeding as directed before, then a third portion of 10 mils of ether and transfer the ether and the remainder of the pancreatin to the filter. Allow the filter and contents to drain, then allow the ether to evaporate spontaneously and dry the beaker and residue to constant weight at 100° C. (212° F.). The residue weighs not more than 0.06 Gm.

Add 0.28 Gm. of Pancreatin and 1.5 Gm. of sodium bicarbonate to 100 mils of tepid distilled water contained in a flask, then add 400 mils of fresh milk which has previously been heated to 40° C. (104° F.), and maintain the temperature of the mixture at this point for thirty minutes. At the end of this time the milk is so completely peptonized that on diluting 3 mils with 9 mils of distilled water and then mixing with 3 mils of acetic acid no coagulation occurs.

Assay.—Shake 10 Gm. or more of powdered potato starch (see Chapter LXII) with about 10 times its weight of cold distilled water, and, after draining the mixture on a filter, wash it with the same quantity of distilled water. Place the washed starch at once in an air bath and maintain a temperature of about 50° C. (122° F.) until the starch is sensibly dry. Reduce it to a fine powder and place it in a well-stoppered bottle. Determine the percentage of water still remaining in the starch by drying about 0.5 Gm. of it in an air bath, gradually raising the temperature to 120° C. (248° F.) and maintaining it at that temperature for four hours. Of the washed and partially dried starch, mix a quantity equivalent to 7.5 Gm. of dry starch in a 400-mil beaker with 10 mils of cold distilled water, add 190 mils of boiling distilled water and boil the mixture gently (for approximately five minutes) with constant stirring until a translucent uniform paste is obtained. Replace the water lost by evaporation and cool the paste to 40° C. (104° F.) on a water bath previously adjusted to this temperature and add a solution of 0.3 Gm. of Pancreatin in 10 mils of distilled water, just previously made at 40° C. (104° F.). Mix well and maintain the same temperature for exactly five minutes, when a thin, nearly clear liquid is produced. At once add 0.1 mil of this liquid to a previously made mixture of 0.2 mil of tenth-normal iodine V.S. and 60 mils of distilled water; no blue, red, or violet color is produced.

N. F. Preparations.—Liquor Pancreatini; Pulvis Pancreatini Compositus.

Uses.—Pancreatin is used to aid digestion. It should not be given in combination with acids; weak alkalies assist its action. The dose is from five to ten grains (0.32 to 0.65 Gm.).

LIQUOR PANCREATINI. N. F. Solution of Pancreatin

[**Liq. Pancreat.**—LIQUOR PANCREATICUS, N. F. III PANCREATIC SOLUTION]

	Metric	Old form
Pancreatin	**17.5 Gm.**	255 gr.
Sodium Bicarbonate	**50.0 Gm.**	1 oz. av. 263 gr.
Glycerin	**250.0 mils**	8 fl. oz.
Compound Spirit of Cardamom	**3.5 mils**	49 min.
Alcohol	**65.0 mils**	2 fl. oz. 38 min.
Magnesium Carbonate	**8.0 Gm.**	112 gr.
Sodium Chloride	**5.0 Gm.**	70 gr.
Chloroform	**2.0 mils**	31 min.
Distilled Water, a sufficient quantity,		
To make	**1000 mils**	2 pints

Triturate the pancreatin, sodium chloride, and the sodium bicarbonate gradually with 625 mils [old form 20 fluidounces] of distilled water; add the alcohol, compound spirit of cardamom and magnesium carbonate; mix them thoroughly by shaking, and pour the mixture upon a wetted filter, returning the first portions of the filtrate until it passes through clear. Wash the filter with sufficient distilled water to obtain 748 mils [old form 23 fluidounces, 449 minims] of filtrate. To this add the chloroform and glycerin and mix. Dose, one fluidrachm (4 mils).

SUPRARENALUM SICCUM. U. S. Dried Suprarenals

[**Supraren. Sicc.**—GLANDULÆ SUPRARENALES SICCÆ U. S. P. VIII DESICCATED SUPRARENAL GLANDS]

The suprarenal glands of animals which are used for food by man, cleaned, dried, freed from fat, and powdered, and containing not less than 0.4 per cent. nor more than 0.6 per cent. of epinephrine, the active principle of the suprarenal gland. One part of Dried Suprarenals represents approximately 6 parts of fresh glands, free from fat. If assayed biologically one gramme of Dried Suprarenals contains the equivalent of ten milligrammes of lævo-methylamino-ethanol-catechol.

Preparation.—The suprarenal glands, as the name indicates, are attached to the upper portion of the kidneys of most animals. The official definition above outlines the conditions under which the dried glands are prepared and a standard for the epinephrine content has been established. This active constituent, *epinephrine,* is alkaloidal in character and was discovered by Dr. John J. Abel. Fuerth also claimed the discovery of an active constituent which he called *suprarenine,* and Takamine introduced a crystalline substance which he named *adrenalin.* These substances proved to be closely related, but were not identical, and the commercial product is known to-day under the latter name.

Adrenalin, $C_9H_{13}O_3N$, is described in the U. S. P. IX, among the reagents, under the chemical name *lævo-methylamino-ethanol-catechol* (see Chapter LXII), and tests are there given for its identity and purity. It could not be recognized in Part I of the Pharmacopœia because of its being a controlled product. Adrenalin is prepared by digesting the finely cut glands with acidulated water for five hours, at about 70° C. (158° F.), then heating to 90° C. (194° F.) to coagulate albuminoids, and expressing the mixture. The digestion in acidulated water is repeated, the expressed liquids freed from fat, concentrated *in vacuo,* mixed with alcohol to precipitate inert constituents, and then precipitated by the addition of ammonia water. The crude adrenalin which separates, after several hours' standing, is purified by solution in acid alcohol and again precipitated by the addition of ammonia water. It is also prepared synthetically.

The U. S. P. description and assay for Dried Suprarenals is as follows:

Official Description.—A light yellowish-brown, amorphous powder.

Odor.—Slight, characteristic.

Solubility.—Partially soluble in water.

Tests for Identity.—Dried Suprarenals contain not more than 7 per cent. of moisture, and the yield of ash does not exceed 7 per cent.

Assay.—Add 0.005 Gm. of finely powdered manganese dioxide and 10 mils of distilled water to 0.01 Gm. of Dried Suprarenals; thoroughly shake the mixture several times during one hour and filter. Compare the color of the filtrate in a test tube or in any convenient manner, with the color of cobaltous chloride T.S. and dilute gold chloride T.S. (see Reagents, Chapter LXII) combined as follows: Mix 1.85 mils of cobaltous chloride T.S. with 0.95 mil of diluted gold chloride T.S. and 7.2 mils of distilled water; the color corresponds to 0.2 per cent. of epinephrine in the filtrate obtained above, 2.95 mils of cobaltous chloride T.S. with 1.25 mils of diluted gold chloride T.S. and 5.8 mils of distilled water corresponds in color to 0.4 per cent. of epinephrine; 4.05 mils of cobaltous chloride T.S. with 1.35 mils of diluted gold chloride T.S. and 4.6 mils of distilled water corresponds in color to 0.6 per cent. of epinephrine; 5.15 mils of cobaltous chloride T.S. with 1.55 mils of diluted gold chloride T.S. and 3.3 mils of distilled water corresponds in color to 0.8 per cent. of epinephrine.

The percentages of epinephrine indicated by the above color standards are based upon the maceration of 0.01 Gm. of the Dried Suprarenals in 10 mils of distilled water as directed above, and filtering. In samples containing more than 0.8 per cent. of epinephrine, 0.005 Gm. of the Dried Suprarenals may be taken—in which case the percentage stated above—as indicated by the color standards, should be doubled. The standard color solutions keep unchanged if sealed in glass tubes.

For a method of assaying Dried Suprarenals, see Biological Assays (Chapter LXII).

Uses.—Desiccated suprarenal glands in powder is used in Addison's disease, and solutions have been employed as hæmostatics. Dose, of the dried glands, four grains (0.25 Gm.).

Adrenalin is largely used for the constriction of blood vessels, high blood pressure following its action on the heart muscles, similar to the effects of digitalis. Its application in medicine, however, is mainly for its local effect, to cause vasoconstriction in hemorrhages in the eye, nose, and throat, and in the treatment of hay fever and bronchial asthma. It is used in aqueous solution in the form of the chloride, the strength varying from 1 in 15,000 to 1 in 1000. The solvent is sometimes distilled water, at other times, for hypodermic use, normal salt solution, and for ointments or as an inhalant the unsalified alkaloid is preferably used, dissolved in oil. The dose is five to thirty minims (0.3 to 2 mils) of the 1 to 1000 solution.

THYROIDEUM SICCUM. U. S. Dried Thyroids

[**Thyroid. Sicc.**—GLANDULÆ THYROIDEÆ SICCÆ, U. S. P. VIII DESICCATED THYROID GLANDS]

The thyroid glands of animals which are used for food by man, freed from connective tissue and fat, dried and powdered, and containing not less than 0.17 per cent. nor more than 0.23 per cent. of iodine (I = 126.92) in thyroid combination. One part of Dried Thyroids corresponds to approximately 5 parts of the fresh glands.

Preparation.—Selected thyroid glands of the sheep are minced, dried, treated with petroleum benzin to remove fat, dried again, and powdered. The active constituent seems to be an organic combination of iodine, sometimes called *thyroglobulin*, for the iodine content of which the U. S. P. has fixed a standard and assay.

Official Description.—A yellowish, amorphous powder.

Odor.—Slight, characteristic.

Dried Thyroids must be free from iodine in inorganic or in any other form of combination than that peculiar to the thyroid.

Tests for Purity.—Dried Thyroids contain not more than 6 per cent. of moisture and the yield of ash does not exceed 5 per cent.

Assay.—Mix 1 Gm. of Dried Thyroids in a nickel crucible of about 125 mils capacity, with 15 Gm. of a mixture composed of 138 parts by weight of anhydrous potassium carbonate, 106 parts of anhydrous sodium carbonate and 75 parts of potassium nitrate. Spread an additional 5 Gm. of this fusion mixture evenly over the surface. Heat the crucible over a free Bunsen flame until no further carbonization is observed, cool it and dissolve the residue in about 150 mils of distilled water, warming to hasten solution. Transfer this solution to an Erlenmeyer flask of about 500 mils capacity and add approximately 50 mils, or its equivalent, of a fresh solution of chlorinated soda (containing 2.4 per cent. of chlorine by weight). Now treat the mixture with enough phosphoric acid, diluted with an equal volume of distilled water, to produce an appreciable yellow tint of free chlorine, then add 10 mils more of the phosphoric acid diluted with an equal volume of distilled water, and boil the contents of the flask for one-half hour or until the volume has been reduced to about 150 mils. Cool the liquid, add 10 mils of an aqueous solution of potassium iodide (1 in 100) and titrate the liberated iodine with freshly prepared two-hundredth-normal sodium thiosulphate V.S., starch T.S. being used as indicator just before the end of the reaction. It shows not less than 0.17 per cent. nor more than 0.23 per cent. of I.

Each mil of two-hundredth-normal sodium thiosulphate V.S. used corresponds to 0.1058 milligrammes of I derived from the Thyroid Glands used. Each gramme of Dried Thyroids corresponds to not less than 16.07 mils nor more than 21.74 mils of two-hundredth-normal sodium thiosulphate V.S.

Uses.—Desiccated thyroid glands in powder is used in myxœdema, for which it may be said to be almost a specific; also in the treatment of cretinism. Dose, one to four grains (0.065 to 0.25 Gm.).

HYPOPHYSIS SICCA. U. S. Desiccated Hypophysis
[**Hypophysis Sic.**—DESICCATED PITUITARY BODY]

The posterior lobe obtained from the pituitary body of cattle, cleaned, dried, and powdered.

Official Description.—A yellowish or grayish, amorphous powder.
Odor.—Characteristic.
Solubility.—It is only partially soluble in water.

U. S. P. Preparation.—Liquor Hypophysis.

The pituitary gland is a small, reddish, ellipsoidal organ situated in a depression of the sphenoid bone and attached to the brain by a pedicle. It consists of two lobes, an anterior portion, which is the larger, and a posterior portion, the part of the gland which is official. Both lobes possess therapeutic activity, but are different in their action. The anterior portion is essential for life, death soon following its removal, and if partially destroyed or if diseased, normal growth is retarded or other evidences of malnutrition follow. The anterior lobe is not largely used in medical practice.

Uses.—The posterior lobe, containing an active principle which has been called *pituitrin,* has a marked effect upon plain muscle, especially upon those of the blood vessels and the uterus. It has been extensively used to stimulate uterine contraction in tedious labor, although it must be used with great caution because of the violence of its action. The dose of the dried gland is one-half grain (0.3 Gm.).

LIQUOR HYPOPHYSIS. U. S. Solution of Hypophysis
[**Liq. Hypophysis**—SOLUTION OF THE PITUITARY BODY]

A solution containing the water-soluble principle or principles from the fresh posterior lobe of the pituitary body of cattle.

Extract the finely minced material with slightly acidulated water, boil the solution for ten minutes and filter it. Sterilize this filtrate and preserve it in a sterile condition in glass containers.

Official Description.—A transparent liquid, colorless or nearly so.
Odor.—Faint, characteristic.
Tests for Identity.—One mil of Solution of Hypophysis, diluted 20 000 times has the same activity on the isolated uterus of the virgin guinea-pig as a 1 to 20,000,000 solution of beta-iminazolyl-ethylamine hydrochloride when tested as directed by the United States Hygienic Laboratory.

Uses.—The solution of pituitary body is the form most frequently used, as it possesses the advantage over the dried glands of more definite standardization, therefore greater dependability. The assay is complicated and requires delicate mechanism and, as the best method is yet to be proven, the U. S. P. has authorized the United States Hygienic Laboratory at Washington, D. C., to prescribe the exact details of the test. Its uses are the same as described under *Desiccated Hypophysis* (see above); the dose being fifteen minims (1 mil).

Antitoxic Serums.—The phenomena of immunity, that is, non-susceptibility, to certain contagious diseases enjoyed by some individuals, and the fact that certain infectious diseases afforded life-long immunity to the same disease, has been observed for many years, and has inspired numerous investigations as to the possible cause. The introduction of cowpox inoculation, first reported by Jenner in 1796, and its immediate success in producing immunity against smallpox, was the first successful application of this principle, which is so large a factor in the modern practice of medicine.

Almost a century passed, however, before another striking advance toward producing artificial immunity was made, although a number of investigators had been at work. In 1890, Behring and Kitasato discovered that by injecting the diphtheria toxin, produced by the diphtheria bacillus, into an animal, the animal at first developed characteristic symptoms, but soon became immune, even to enormous doses of the toxin. They then further discovered that if the blood be drawn from this immunized animal and the serum collected, this serum would successfully neutralize the toxins of diphtheria when present in other animals. Its first practical application in the treatment of diphtheria in man was announced by Roux in 1894, and was soon followed by the production of serum for the prevention and treatment of tetanus, and for many other diseases (see page 1458), although the greatest success has been attained in diphtheria and tetanus, since in these diseases the toxins are soluble.

The antitoxic principles present in the serum from immunized animals have never been successfully isolated in pure form, but they are closely associated with the globulins of the blood. They exist in all of the body juices of the immunized animal, but the blood serum is always used as the source of the commercial product.

Various theories attempting to explain the action of antitoxins have been advanced, although none have been universally accepted. Ehrlich's hypothesis is known as the "side-chain" theory. He believed that the toxin consists of two groups called, respectively, *heptophore* and *toxophore.* The protoplasm of living cells is supposed to consist of a central nucleus having a number of *side-chains or receptors* which supply nutriment to the cell, taking it from the blood or lymph. To explain the fact that immunity is specific, that is, for only one disease at one time, it is suggested that there must be specific receptors for each form of protein. When a toxin is introduced, its heptophore group combines with its specific receptor, and the toxophore group thus exerts its toxic action upon the central nucleus. If the toxin is in sufficient amount or is not destroyed promptly, the protoplasm is fatally injured and death results. If only small amounts of toxin are introduced, only a portion of the side-chains are injured and enough remain to provide nutriment; under these conditions the cell seems to be stimulated to produce many more of the specific receptors for that toxin, and, if the injection or development of toxin continues, they become so numerous as to be detached from the nucleus and float in the blood. Under these conditions they yet retain their power to unite with the toxin molecule through their heptophore group, thus preventing their union with the living cell, and in this way render the toxin inert and explain the action of the antitoxins.

Immunity is artificially produced in two ways: If antitoxin developed in one animal is injected into man or another animal, it is spoken of as *passive immunity;* if, however, the patient develops the antitoxin or antibodies in his own body, it is termed *active immunity.*

The use of serums belongs to the first class, *i.e.*, passive immunity; the use of vaccines or bacterial toxins gives active immunity (see page 1461).

Various large domestic animals have been employed for the development of the antitoxic serum, as the dog, the goat, the ox, and the horse, but the last two, especially the horse, are now depended upon for the supply, mainly because of the large quantities of blood which may be drawn and also because the serum is less likely to cause disturbances when injected into the human body.

Three forms of serum are recognized in the Pharmacopœia: First, the clear serum, separated from the coagulated blood and preserved with a small amount of cresol or phenol; second, the so-called ''purified serum'' or globulins, prepared by precipitating the antitoxic-bearing serum, through the addition of ammonium sulphate, with subsequent purification and solution in sterile distilled water, and then enough sodium chloride to produce a solution similar in strength to normal salt solution. Preservatives are also added. Through this treatment, many albuminous substances are removed from the product, constituents which are likely to cause side reactions, and the potency or ability to neutralize toxins may also be greatly increased; third, the serum or the precipitated globulins may be carefully dried under sterile conditions and kept in containers free from air until needed. It is then to be dissolved under aseptic conditions in distilled water or normal salt solution. The U. S. Pharmacopœia has only recognized two serums, the antidiphtheric and antitetanic, although each is official in the three forms. The official text is as follows:

SERUM ANTIDIPHTHERICUM. U. S. Antidiphtheric Serum
[Ser. Antidiph.—DIPHTHERIA ANTITOXIN]

A fluid, having a potency of not less than 250 antitoxic units per mil, separated from the coagulated blood of the horse, *Equus Caballus* Linné (Fam. *Equidæ*), or other large domestic animal, which has been properly immunized against diphtheria toxin. It must be kept in sealed glass containers in a dark place, at a temperature between 4.5° and 15° C. (40° and 59° F.).

Preparation.—The first step is the development of the toxin; this is produced by growing the particular bacilli, against which the antitoxin is to be effective, upon a nutrient bouillon, at incubation temperature. When the culture has developed sufficiently, the bacteria are removed by filtering through a porcelain filter, and the filtrate constitutes the solution of toxin.

This solution is now injected into a horse, at first in small amounts and then in larger doses, time being allowed after each inoculation for the resulting constitutional reactions, as fever, loss of appetite, etc., to pass away, until within a few months the horse is usually able to withstand the injection of enormous amounts of the solution of toxin, showing only slight symptoms. Some horses fail to react, never developing immunity, while others produce serum of very high potency.

The blood is now drawn, from the external jugular vein, into sterile cylindrical jars, and allowed to clot. In a few days the clear serum may be drawn off and filtered through a germ-proof porcelain filter, when after standardizing and adding the preservative of phenol or cresol it constitutes the commercial antitoxic serum.

Standardization.—The activity of antidiphtheric serum is based upon what is called the *immunity unit,* which is a measure of strength, not of volume. This standard was developed by Ehrlich, but is supplied to the American market by the Hygienic Laboratory of the United States Public Health Service. The immunity unit may be defined as the neutralizing power possessed by an arbitrary quantity of a diphtheria antitoxic serum which has been kept under special conditions to prevent deterioration in an authorized laboratory. The only authorized laboratory in the United States is the Hygienic Laboratory, and the standard serum, after having its potency adjusted, is evaporated *in vacuo,* transferred to a tube in which the air is replaced by phosphoric anhydride, to exclude oxygen, hermetically sealed, and kept in absolute darkness and at a constant temperature of 5° C. (41° F.).

To standardize an antitoxic serum, the operator first determines the amount of a certain toxin which will be exactly neutralized by this immunity unit when injected together into a 250 Gm. guinea-pig. The indication that the toxin has been neutralized is its failure to kill the animal. This toxin dose is termed the *"L° dose."* In determining this factor, a series of guinea-pigs are injected with the standard immunity dose of antitoxin and also with varying amounts of toxin. When the L° dose has been determined, the smallest amount of toxin which will kill the guinea-pig within four days, notwithstanding the presence of the standard dose of antitoxin, is also noted. This quantity is called the "L + dose." Theoretically the L° dose of toxin just neutralizes 200 *"combining units"* of antitoxin, a *"combining unit"* being the one two-hundredth of an immunity unit; each combining unit being capable of neutralizing the lethal or fatal dose of toxin for a 250 Gm. guinea-pig. The *immunity unit,* therefore, should neutralize 200 doses of toxin, each of which would be capable of killing a 250 Gm. guinea-pig.

The *antitoxic unit* must, however, contain more antitoxin than the immunity unit, enough to save the life of a 250 Gm. guinea-pig when injected together with the "L + dose" of toxin, and 3000 units therefore represent an antitoxic power capable of saving the life of 3000 such guinea-pigs, each injected with the L + dose of toxin.

Official Description.—A yellowish or yellowish-brown, transparent or slightly turbid liquid, with sometimes a slight granular deposit.

Odor.—Nearly odorless, or having an odor due to the presence of an antiseptic used as a preservative.

Tests for Identity and Purity.—Antidiphtheric Serum gradually loses in potency, the loss in one year varying between 10 per cent. and 30 per cent. The serum must come from healthy animals, must be sterile, must be free from toxins or other bacterial products, and must not contain an excessive amount of preservative (not more than 0.5 per cent. of phenol or cresol, when either of these is used), and the total solids must not exceed 20 per cent. Serum of a lower potency than 250 units per mil must not be sold or dispensed. Only such Sera may be sold or dispensed as have been prepared and propagated in establishments licensed by the Secretary of the Treasury of the United States.

The United States law requires that each container of Serum sold or dispensed by licensed establishments shall bear upon the label, in addition to the name of the Serum, the name, address and license number of the manufacturer, and the date beyond which the product cannot be expected to yield its specific results. The label must also contain the laboratory number of the Serum and the total number of antitoxic units claimed for the contents of the container.

The standard of strength, expressed in units of antitoxic power, shall be that established by the United States Public Health Service.

The protective or immunity dose is 1000 units, but the usual dose for effecting a cure is 10,000 units.

SERUM ANTIDIPHTHERICUM PURIFICATUM. U. S. Purified Antidiphtheric Serum

[**Ser. Antidiph. Purif.**—ANTIDIPHTHERIC GLOBULINS CONCENTRATED DIPHTHERIA ANTITOXIN DIPHTHERIC ANTITOXIN GLOBULINS REFINED AND CONCENTRATED DIPHTHERIA ANTITOXIN]

A solution in physiological solution of sodium chloride of certain antitoxic substances obtained from the blood serum or plasma of the horse, *Equus Caballus* Linné (Fam. *Equidæ*), or other large domestic animal, which has been properly immunized against diphtheria toxin. After the serum or plasma from the immunized animal has been collected, the antitoxin-bearing globulins are separated from the other constituents of the serum or plasma and dissolved in water; and sufficient sodium chloride is then added to make a solution containing from 0.6 to 0.9 per cent. of the salt. It has a potency of not less than 250 antitoxic units per mil. It must be kept in sealed glass containers in a dark place, at a temperature between 4.5° and 15° C. (40° and 59° F.).

Official Description.—A transparent or slightly opalescent liquid, with sometimes a slight granular or ropy deposit. The liquid is sometimes more or less viscous.

Odor.—Nearly odorless, or having an odor due to the presence of the antiseptic used as a preservative.

Tests for Identity and Purity.—The serum must come from healthy animals, must be sterile, must be free from toxins or other bacterial products, and must not contain an excessive amount of preservative (not more than 0.5 per cent. of phenol or cresol, when either of these is used), and the total solids must not exceed 20 per cent. Serum of a lower potency than 250 units per mil must not be sold or dispensed

Purified Antidiphtheric Serum must comply with the requirements for loss of potency, control, labeling, and standard for potency under *Serum Antidiphthericum.*

The dose is the same as for antidiphtheric serum.

SERUM ANTIDIPHTHERICUM SICCUM. U. S. Dried Antidiphtheric Serum

[Ser. Antidiph. Sicc.—Dried Diphtheria Antitoxin]

Dried Antidiphtheric Serum is obtained by the evaporation of either Antidiphtheric Serum or Purified Antidiphtheric Serum in a vacuum over sulphuric acid or other desiccating agent, or by passing over it a current of warm air freed from bacteria. It has a potency of not less than 4000 units per gramme. It must be kept in hermetically sealed, amber-colored glass containers free from air, at a temperature between 4.5° and 15° C. (40° and 59° F.), preferably in a dark place.

Official Description.—The Dried Serum is either in the form of orange or yellowish flakes or small lumps, or as a yellowish-white powder.
Odor.—Without odor.
Tests for Identity and Purity.—The Serum is soluble in nine parts of distilled water, but the solution is opalescent and slightly viscous; it may be dissolved more readily in larger amounts of distilled water or physiological solution of sodium chloride. Immediately before use the Serum must be dissolved in recently boiled and cooled distilled water under the most rigid aseptic conditions. The solution must be used immediately and if there should be any serum or solution remaining, it must be discarded. Dried Antidiphtheric Serum if kept as directed does not lose in potency, as does the liquid serum.
It must comply with the requirements for control and labeling under *Serum Antidipthericum* and the standard of strength, expressed in units of antitoxic power, shall be that established by the United States Public Health Service.

The dose is the same as for Antidiphtheric Serum.

SERUM ANTITETANICUM. U. S. Antitetanic Serum

[Ser. Antitetan.—Tetanus Antitoxin]

A fluid, having a potency of not less than 100 units per mil, separated from the coagulated blood of the horse, *Equus Caballus* Linné (Fam. *Equidæ*), or other large domestic animal, which has been properly immunized against tetanus toxin. It must be kept in sealed glass containers in a dark place, at a temperature between 4.5° and 15° C. (40° and 59° F.).

Preparation.—Antitetanic serum is prepared in a manner similar to that described for antidiphtheric serum (see page 1454), the only important difference being due to the fact that the tetanus bacillus belongs to the group of bacteria known as anaërobes, which thrive only in the absence of oxygen, and therefore, in preparing the toxin, it must be grown in deep vessels, in broth which has been freshly heated to free it from oxygen.

Official Description.—A yellowish or yellowish-brown, transparent, or slightly turbid liquid with sometimes a slight granular deposit.
Odor.—Nearly odorless, or having an odor due to the presence of the antiseptic used as a preservative.
Tests for Identity and Purity.—Antitetanic Serum gradually loses in potency, the loss being greater at higher than at lower temperatures. The Serum must come from healthy animals, must be sterile, must be free from toxins or other bacterial products, and must not contain an excessive amount of preservative (not more than 0.5 per cent. of phenol or cresol, when either of these is used), and the total solids must not exceed 20 per cent. Serum of a lower potency than 100 units per mil must not be sold or dispensed. Only such Sera may be sold or dispensed as have been prepared and propagated in establishments licensed by the Secretary of the Treasury of the United States.
The United States law requires that each container of Serum sold or dispensed by licensed establishments shall bear upon the label, in addition to the name of the Serum, the name, address and license number of the manufacturer and the date beyond

which the contents cannot be expected to yield its specific results. The label must also contain the laboratory number of the Serum and the total number of antitoxic units claimed for the contents of the container.

The standard of strength, expressed in units of antitoxic power, shall be that established by the United States Public Health Service.

Uses.—The use of tetanus antitoxin must be considered rather as a preventive than a curative measure. Although there are many cases on record where the life of the patient has been saved when its administration was only begun after muscular spasms occurred, yet its best results are obtained when administered before the tetanus toxins have invaded the motor nerve cells and when it acts by neutralizing the toxin itself and rendering it harmless. Deeply-seated wounds which heal on the surface are especially dangerous, such as those produced by a Fourth-of-July accident, when contaminating material is driven into the tissues by a nearby explosion, or wounds, particularly puncture wounds from nails, on horses or on persons connected with stables, where manure, one of the best carriers of the tetanus bacilli, is present; and also wounds received in warfare. The injection of an immunity dose of the tetanus serum, in instances like those cited, should follow as soon after the injury as possible and be repeated at weekly intervals until the wound is completely healed. All wounds should be widely opened, cleaned, packed with gauze to permit free drainage, and treated surgically until healed. The dried antitetanic serum is often used as a dusting powder on wounds. The protective or immunity dose is 1500 units, and this dose should be repeated every eight days as long as the condition of the wound indicates the possibility of the continued presence therein of the tetanus bacillus or its spores. The usual dose in the treatment of tetanus is 10,000 units, but this is often greatly increased.

SERUM ANTITETANICUM PURIFICATUM. U. S. Purified Antitetanic Serum

[**Ser. Antitetan. Purif.**—ANTITETANIC GLOBULINS CONCENTRATED TETANUS ANTITOXIN REFINED AND CONCENTRATED TETANUS ANTITOXIN TETANUS ANTITOXIN GLOBULINS]

A solution in physiological solution of sodium chloride of certain antitoxic substances obtained from the blood serum or plasma of the horse, *Equus Caballus* Linné (Fam. *Equidæ*), or other large domestic animal, which has been properly immunized against tetanus toxin. After the serum or plasma from the immunized animal has been collected, the antitoxin-bearing globulins are separated from the other constituents of the serum or plasma and dissolved in water; and sufficient sodium chloride is then added to make a solution containing from 0.6 to 0.9 per cent. of the salt. It has a potency of not less than 100 units per mil. It must be kept in sealed glass containers in a dark place, at a temperature between 4.5° and 15° C. (40° and 59° F.).

Official Description.—A transparent or slightly opalescent liquid, with sometimes a slight granular or ropy deposit. The liquid is sometimes more or less viscous.

Odor.—Nearly odorless or having an odor due to the presence of the antiseptic used as a preservative.

Tests for Identity and Purity.—The serum must come from healthy animals, must be sterile, must be free from toxins or other bacterial products, and must not contain an excessive amount of preservative (not more than 0.5 per cent. of phenol or of cresol, when either of these is used), and the total solids must not exceed 20 per cent. Serum of a lower potency than 100 units per mil must not be sold or dispensed.

Purified Antitetanic Serum must comply with the requirements for loss of potency, control, labeling, and standard for potency under *Serum Antitetanicum.*

The dose is the same as for Antitetanic Serum.

SERUM ANTITETANICUM SICCUM. U. S. Dried Antitetanic Serum

[**Ser. Antitetan. Sicc.**—Dried Tetanus Antitoxin]

Dried Antitetanic Serum is obtained by the evaporation of either Antitetanic Serum or Purified Antitetanic Serum in a vacuum, over sulphuric acid or other desiccating agent, or by passing over it a current of warm air freed from bacteria. It has a potency of not less than 1000 units per gramme. It must be kept in hermetically sealed amber-colored glass containers, free from air, at a temperature between 4.5° and 15° C. (40° and 59° F.), preferably in a dark place.

Official Description.—Dried Antitetanic Serum is either in the form of orange or yellowish flakes or small lumps, or a yellowish-white powder.

Odor.—Without odor.

Tests for Identity and Purity.—The serum is soluble in nine parts of distilled water, but the solution is opalescent and slightly viscous; it may be dissolved more readily in larger amounts of distilled water or physiological solution of sodium chloride. For use the serum must be dissolved in recently boiled and cooled distilled water under the most rigid aseptic conditions. The solution must be used immediately and, if there should be any serum or solution remaining, it must be discarded. Dried Antitetanic Serum if kept as directed does not lose in potency, as does the liquid serum. It is sometimes used as a dusting powder or for local application to infected wounds.

It must comply with the requirements for control and labeling under *Serum Antitetanicum* and the standard of strength, expressed in units of antitoxic power, shall be that established by the United States Public Health Service.

The dose is the same as for Antitetanic Serum.

Unofficial Serums

Diphtheria antitoxin and tetanus antitoxin are the only antitoxic serums in common use, and official, in this country. Other therapeutic serums are not produced by injecting toxins alone as are these because the causative bacteria do not produce soluble toxins, at least when growing in artificial culture media. In lieu of toxins, autolyzed cultures containing toxic substances formerly considered antitoxins are sometimes used. Horses producing the antibacterial serums, however, are injected chiefly with cultures of the whole bacteria.

Antianthrax Serum.—Prepared by injecting horses subcutaneously with living cultures; first of anthrax vaccine and then of highly virulent anthrax bacilli. Standardized by determining content in agglutinins. Dose 10 to 50 mils given preferably intravenously according to indications.

Antidysenteric Serum.—Dysentery bacilli are divided into two main groups with regard to their ability to ferment mannit. The Shiga type does not ferment mannit; the Flexner type does ferment mannit. There are several variants in the Flexner group. The serum is prepared by injecting cultures of dysentery bacilli of all types into horses. Autolysates are sometimes used. There is no satisfactory method for the standardization of the serum. An estimation of agglutinin content is usually made. Attempts to estimate the anti-infectious value of the serum upon animals have met with some success experimentally. Used in the treatment of dysentery in doses of 20 to 60 mils every 8 hours, p.r.n.

Antigonococcic Serum.—Prepared like antidysenteric serum, except that, as a rule, rams are used instead of horses. They are injected with autolysates and suspensions of gonococci. Used in chronic conditions due to gonococcic infections. Dose, 2 mils every two to four days.

Antimeningitic Serum.—There are four distinct types of the meningococcus. Serums are prepared by injecting horses intravenously with suspensions of meningococci. Polyvalent serums are made by treating the animal with all four types. Specific serums are produced by the injection of a single type. Polyvalent serum is to be used immediately; specific serum after type diagnosis has been made. When type diagnosis is impossible the polyvalent serum is used throughout. The serums are standardized by determining their ability to protect mice against living cultures of meningococci. For the best results serum should be administered early in the disease and treatment persisted in. Dose, 15 to 60 mils injected intraspinally according to age of patient.

Antipneumococcic Serum.—Prepared like antimeningitic serum. There are three fixed types of the pneumococcus known as Types I, II, and III, and a fourth group of heterogeneous strains. Serums are polyvalent and specific, as in the case of antimeningitic serum, and indications for use are similar. Pneumonia caused by pneumococcus, Type I, has been found the most amenable to treatment. The serums are standardized by determining their ability to prevent the death of mice receiving large doses of highly virulent living cultures. The standard strength for polyvalent serum with regard to Type I and for specific Type I serum is that 0.2 mils of the serum under test must prevent the death of a mouse receiving 0.1 mil of a bouillon culture so virulent that 0.000001 of a mil will kill the control mouse. Dose, 50 to 100 mils given intravenously every 6 to 24 hours according to condition of patient.

Antistreptococcic Serum.—Prepared like antimeningitic serum, using killed bouillon or agar cultures of streptococci, obtained from a great variety of streptococcus infections such as septicemia, endocarditis, erysipelas, scarlet fever, etc. Streptococci have not been successfully classified as have meningococci and pneumococci. All serums are therefore polyvalent. Antistreptococcic serum has been used in the treatment of the diseases named, also in puerperal sepsis, acute tonsillitis, pneumonia due to the streptococcus and other streptococcus infections. Standardization cannot be accomplished successfully until more is learned with regard to the classification of streptococci. Dose, from 10 to 100 mils every 6 to 8 hours given preferably intravenously in order to get the immediate effect of the serum.

Normal Serum.—This is the blood serum obtained from a normal, healthy horse, collected and preserved under aseptic conditions. It has been used with success in hemorrhage or when a tendency to bleed develops or exists normally in the individual. It may be applied directly to the wound or 20 mils may be injected subcutaneously on the day preceding an operation, or it may be administered by mouth, 30 to 80 mils being given within twenty-four hours.

VIRUS VACCINICUM. U. S. Vaccine Virus

[**Virus Vaccin.**—Glycerinated Vaccine Virus Smallpox Vaccine Jennerian Vaccine]

The pustules of vaccinia or cowpox from healthy vaccinated animals of the bovine species, removed and prepared under aseptic conditions.

The vaccine pulp should be thoroughly rubbed up in a mortar, or passed through a special grinder, strained to remove coarse particles, and made into a smooth emulsion with a glycerin solution. Vaccine Virus gradually loses in potency, the loss being more rapid at high than at low temperatures. Preserve it at a temperature between 4.5° and 15° C. (40° and 59° F.), protected from light.

Vaccine Virus has been used for more than a century and has thoroughly proved its value as a preventive of the much-dreaded disease, smallpox. It had been observed that in the epidemics of this disease which swept over England in the last century the dairymaids were immune and it developed that those who had been inoculated with cowpox, a much less serious disease, became very resistant to smallpox. Edward Jenner brought this fact to the attention of the medical profession in 1796, and its use soon became general. For many years the vaccine material was secured by using scabs from the arms of persons successfully vaccinated, and this usually conveyed many other objectionable forms of infection in addition to the vaccine. Improvements, however, were gradually introduced and the modern method for its production is as follows:

Preparation.—In this country calves are exclusively used for the development of vaccine virus. Having been proved to be free from disease, the calves are washed, clipped, then scrubbed with antiseptic solution, afterwards given an alkaline bath and thoroughly rinsed with sterile water, and finally the area where the inoculation is to be made is shaved. The animal is now placed upon an operating table where aseptic conditions are maintained, and vaccinated over the belly and the inside of the legs. The calf is now kept in a specially built stable for about six days, the greatest care being taken to maintain cleanliness and freedom from infection. During this time the pustules have developed, with practically no pus formation, and the virus is then removed under rigid aseptic conditions. The virus is now mixed with glycerin and exposed to a temperature of 12° to 15° C. (53.6° to 59° F.), until all pathogenic bacteria are destroyed, and then prepared for use under aseptic conditions by drawing it into capillary tubes, or drying it on glass points. When ready for the market it is stored in a refrigerator at a temperature between –5° and –10° C. (23° and 14° F.). Under these conditions it may be preserved indefinitely without deterioration. It is important for the pharmacist to know, however, that it loses all potency in a short time if exposed to even body temperature, and should never be carried in the pocket and always, when possible, be kept on ice. Noguchi has developed a method for producing a sterile vaccine in the testicles of rabbits. This method has not yet been used for the preparation of vaccine for the market.

The following regulations have been established by the Pharmacopœia, and these conform to the regulations issued by the United States Public Health Service: "Only such Vaccine Virus may be sold as has been prepared in establishments licensed by the Secretary of the Treasury of the United States. The law and the regulations demand that the following requirements be observed: No Vaccine shall be used from any animal having a communicable disease, or suspected of having a communicable disease, other than vaccinia; animals used for propagating Vaccine Virus must be under daily veterinary examination for a period of not less than seven days before vaccination, and as soon as the vaccine pulp is removed a necropsy shall be made on each animal and permanent records kept. Each lot of Vaccine Virus shall be examined to determine its freedom from pathogenic microörganisms and a special examination must be made of each lot to determine the absence of tetanus spores or toxin, and permanent records must be kept of these examinations. The Virus must be marketed in sterile containers that comply with the requirements of the law and the regulations established by the United States Public Health Service.

"Each package of Vaccine Virus shall bear upon the label the name, address, and license number of the manufacturer, and the date beyond which the contents cannot be expected to yield their specific results. The label should also contain the laboratory number of the Virus." *U. S.*

Bacterial Vaccines or Bacterins

Bacterins or bacterial vaccines consist of suspensions of killed pathogenic bacteria in physiological solution of sodium chloride and standardized by determining the number of bacteria suspended in each mil or Cc.

The Pharmacopœia has not recognized any representatives of this class of biological products, but their importance and large use justifies a brief consideration here.

Vaccine for many years was understood to mean the virus used for inoculation against smallpox, but it now has a much wider application. It represents that class of remedies which produce active immunity, stimulating the patient's body to produce additional supplies of antibodies and thus increase the resistance to disease.

Various forms of antibodies are known. Antibodies are the specific bodies or properties produced by organisms for the purpose of resisting disease-producing organisms or their toxins.

The antitoxins are antibodies which neutralize the toxins formed by bacteria. The antibodies which seem to prepare or alter bacteria so that they may be readily destroyed by the phagocytes are termed *opsonins*. Opsonins are present in normal serum to a certain extent but seem to have no specific action on special bacteria.

Bacterial Vaccines are of two kinds: First, *autogenous*, those prepared from cultures obtained from the patient; second, *stock vaccines*, or those prepared from representative types of the organisms in question. To be of the greatest value, stock vaccines are usually made from a great number of different strains of the same bacterial species. These are termed *polyvalent vaccines*. When a vaccine is made from two or more strains of different species of bacteria, it is termed a *mixed vaccine*.

Sensitized bacterial vaccines or *serobacterins* are a special form of bacterins proposed by Besredka and are prepared by treating the bacteria with a serum obtained from animals immunized against the disease for which the bacterin is being prepared. It is claimed that they act more quickly than ordinary bacterins, and usually cause less local reaction at the point of injection.

A list of some of the more important stock vaccines is given below:

Acne Bacterin.—It is used in acute or chronic acne when caused by the acne bacillus. The initial dose is 5 to 25 million killed bacteria.

Cholera Bacterin.—For immunizing against cholera. Prepared from cholera spirillum. Dose, 500 million killed spirilla in first dose, 1000 million ten days later and after another interval of ten days another 1000 million.

Coli Bacterin (Colon).—Used for infections caused by Bacillus coli communis, such as cystitis, catarrhal jaundice, etc. Initial dose, 10 to 50 million killed bacteria.

Diphtheria Bacterin.—Used in the treatment of diphtheria carriers.

Furunculosis Bacterin.—Prepared from cultures of staphylococcus aureus and staphylococcus albus, obtained from boils or abscesses. Used in the treatment of boils, carbuncles, pustular acne and similar conditions. Initial dose, 100 to 150 million killed organisms.

Gonococcus Bacterin (Neisser-Bacterin).—Used in gonorrhea, epididymitis, rheumatism, etc. Initial dose, 10 to 50 million killed bacteria.

Hay Fever Vaccines.—These are prepared by extracting plant pollens known to cause hay fever, with water or saline solution. The active causative agent of hay fever is the protein contained in the pollen. The extracts are standardized by noting the amount of pollen extracted, or better by estimating the protein content of the extract by the Kjeldahl method. Spring hay fever, sometimes erroneously called "rose cold," is caused chiefly by the pollens of the common grasses; fall hay fever by rag weed pollen. Certain individuals are susceptible to other pollens dependent somewhat upon locality. For instance, pollen of the cottonwood is a cause of hay fever where this tree abounds. The vaccine is used both prophylactically and therapeutically. The initial dose usually contains 0.0025 mgm. of protein nitrogen. For prophylaxis this dose is gradually increased at five- to seven-day intervals, starting six to eight weeks before the season, until a maxium dose of 0.02 mgm. is reached. For treatment, the increase in dosage and intervals depend upon the individual patient.

Influenza Bacterin (Catarrhal Vaccine).—A mixture of the most common catarrhal organisms. Used in the treatment of colds, influenza, and pulmonary infections.

Meningococcic Bacterin.—Used for producing immunization against cerebrospinal meningitis. For immunity, three doses are given of 500, 1000, and 1000 million killed bacteria.

Pertussis Bacterin.—Used for the treatment of whooping-cough and also for immunization. Initial dose, for children less than one year old, 250 million of killed Bordet-Gengou bacillus. For children more than one year old, the initial dose should be 500 million. Increased doses should be given every second day as follows: 500, 1000, 2000, 4000 and, if necessary, as much as 10,000 million. For immunity three doses are given of 500, 1000, and 2000 million organisms at three-day intervals.

Plague Bacterin (Haffkine's Vaccine for Bubonic Plague, Antiplague Vaccine, Antipest Vaccine).—Used for immunization, being an emulsion of the plague bacilli. The first dose contains one billion killed bacilli, followed in ten days by an injection of two billion organisms.

Pneumococcus Bacterin.—Used in pneumonia, cystitis, and empyema. Initial dose, 10 to 50 million killed bacteria. Repeat every four to eight hours in pneumonia.

Pyorrhea Bacterin.—Prepared from strains of bacteria isolated from cases of pyorrhea alveolaris and used in the treatment of that disease.

Rabies or Hydrophobia Vaccine.—This is prepared from the spinal cord or brain tissue of a rabbit infected with rabies. The infected tissue is weakened for the first injections by drying or by dialyzing a suspension of the mixture, and an emulsion is then made; this constitutes the vaccine. Injections are continued for from twelve to twenty-one days, depending upon the particular treatment followed, and during this time the activity of the vaccine is gradually increased until the patient becomes immune. The treatment must commence as promptly as possible after the patient has been bitten by the dog.

Scarlet Fever Bacterin (*Scarlatina Bacterin*).—Used in the treatment of scarlet fever and post-scarlatinal infections. Initial dose, 10 to 50 million killed bacteria.

Staphylococcus Bacterin.—Prepared from staphylococcus aureus and staphylococcus albus obtained from furuncles. Used in furunculosis, acne, and sycosis. Initial dose, 50 to 250 million killed organisms.

Staphylo-Acne Bacterin.—Used in acne due to mixed infection. Initial dose, 50 to 250 million killed bacteria.

Streptococcus Bacterin.—Used in abscesses or cystitis. Initial dose, 1C to 50 million killed organisms.

Typhoid Bacterin.—Used for immunizing against typhoid fever or in its treatment. For immunity, 500 million killed bacteria are first injected, in ten days 1000 million more and after another ten days 1000 million additional. The treatment dose is 50 to 250 million killed organisms, the dose being progressively increased.

Typhoid Bacterin, Mixed.—Contains the typhoid bacillus and the paratyphoid bacilli "A" and "B." The dosage with regard to the typhoid bacillus is the same as in the plain typhoid vaccine with one-half these amounts of each of the paratyphoid bacilli. Typho-bacterin mixed is used exclusively in the American Army—plain typho-bacterin having been discontinued.

Other Biological Products

Tuberculin.—This is a substance obtained from cultures of the *tubercle bacillus* or the medium in which it has grown. Its value is chiefly in diagnosis, as it produces a specific reaction in animals infected with tuberculosis, but it is also used for its curative action. There are several forms of tuberculin used:

Old Tuberculin (*O. T.*) was the original form proposed by Koch and is prepared from pure cultures of tubercle bacillus grown for five or six weeks on 5 per cent. glycerin bouillon. It is then evaporated to one-tenth its volume and the bacteria removed by filtration.

Bacillin Emulsion. (*B. E.*).—It is prepared by drying the well-washed, living, tubercle organisms and then grinding them in a porcelain ball mill for several weeks. The residue is then suspended in 50 per cent. glycerin and standardized. It is similar to a bacterin except that the organisms are ground.

Tuberculin Denys (*Bouillon Filtrate* or *B. F.*).—Similar to Old Tuberculin but prepared without heat and not concentrated.

MOSCHUS. U. S. Musk

[**Mosch.**—Tonquin Musk Deer Musk]

The dried secretion from the preputial follicles of *Moschus moschiferus* Linné (Fam. *Moschidæ*). Preserve it carefully in glass-stoppered bottles.

Official Description.—Usually in small irregular granules, not more than 2 mm. in thickness, blackish with a few brown fragments and becoming somewhat grayish on aging; glistening and somewhat oily.

Odor, Taste, and Reaction.—Odor peculiar, penetrating, powerful and persistent; taste somewhat bitter. Its aqueous solution is slightly acid to litmus.

Tests for Identity and Purity.—Add a few granules of Musk to 2 mils of water in a watch crystal and stir with a glass rod; a light brown solution is obtained. The undissolved portion consists of irregular fragments containing a finely granular substance, numerous rod-like bacteria and occasionally the hyphæ of a fungus.

Add a drop of iodine T.S. to a few granules of Musk on a slide and examine it under the microscope; the particles are not colored blue or bluish-black (*starch*).

Add a few granules of Musk to 2 mils of alcohol contained in a watch crystal; the grains sink to the bottom, and upon stirring with a glass rod, a pale brown, slightly cloudy solution is obtained, leaving a somewhat oily stain upon the upper portion of the watch crystal as the alcohol evaporates; the undissolved portion or residue resembles that obtained with the aqueous mixture, except that the particles are less disintegrated.

Add a few granules of Musk to 2 mils of chloroform in a watch crystal; the grains float on the surface and upon stirring with a glass rod, the solution remains nearly colorless, and as it evaporates there separates around the particles a small quantity of a whitish, oily or fatty substance.

Not less than 50 per cent. of Musk is soluble in water, the solution having a strong, distinctly characteristic odor.

Not less than 10 per cent. of Musk is soluble in alcohol, the solution being of a light, yellowish-brown color and becoming slightly turbid upon the addition of water.

Musk loses not more than 15 per cent. of moisture when dried to constant weight in a desiccator over sulphuric acid.

Musk yields not more than 8 per cent. of ash.

U. S. P. Preparation.—Tinctura Moschi.

Musk contains cholesterin, ammonia, an acid principle, wax, fat, albuminous and gelatinous principles, and an odorous matter not yet determined. When ignited with free access of air, musk gives off a peculiar, somewhat urinous odor.

Uses.—Musk is antispasmodic and stimulant. It is used in the form of suppositories as a stimulant in the exhaustion of typhoid fever. Dose, four to fifteen grains (0.25 to 1 Gm.).

ACIDUM LACTICUM. U. S. Lactic Acid

[Acid. Lact.]

A liquid containing lactic acid [optically inactive alphahydroxypropionic acid [$C_3H_6O_3$ or $CH_3.CHOH.COOH = 90.05$] and lactic anhydrides, equivalent to a total of not less than 85 per cent. nor more than 90 per cent. of $C_3H_6O_3$.

Preparation.—Lactic acid may be made from sour milk, cheese, meat juice, lactin, and from many vegetable products. Formerly it was obtained from cheese, and owing to its frequent occurrence in the decomposition of animal products it is considered here. It is now most conveniently prepared by treating cane sugar with sulphuric acid, so as to convert it into invert sugar, then adding solution of caustic soda and heating the mixture until it ceases to precipitate Fehling's solution, showing the absence of sugar. Sulphuric acid is added, and the sodium sulphate formed is crystallized out, an addition of alcohol causing the precipitation of the remainder. The alcoholic liquid contains impure lactic acid; one-half of it is heated and zinc carbonate added until effervescence ceases; the other half of the alcoholic liquid is now added and the whole allowed to cool. Zinc lactate crystallizes out; this, by treatment with hydrogen sulphide, yields zinc sulphide, lactic acid remaining in solution.

Official Description.—Lactic Acid is a colorless, or slightly yellow, syrupy liquid, absorbing moisture on exposure to air.

Odor, Taste, and Reaction.—Nearly odorless, having an acid taste. Lactic acid is strongly acid to litmus.

Solubility.—It is miscible with water, alcohol, or ether; insoluble in chloroform, petroleum benzin, or carbon disulphide.

Specific Gravity.—About 1.206 at 25° C. (77° F.).

Tests for Identity.—Lactic Acid is not vaporized at a temperature below 160° C. (320° F.); at a higher temperature it emits inflammable vapors.

Add about 0.1 Gm. of potassium permanganate to 2 mils of a mixture of equal volumes of lactic and sulphuric acids, and heat it gently; the odor of aldehyde becomes perceptible.

Not more than 0.006 Gm. of ash remains on incinerating 5 mils of Lactic Acid.

Impurities and Tests for Impurities.—*Chlorides.*—Ten mils of a solution of the Acid in distilled water (1 in 100) is not rendered opalescent by 1 mil of silver nitrate T.S.

Sulphate.—Separate portions of 10 mils each of an aqueous solution of the acid (1 in 20) remain unaffected by the addition of 1 mil of barium chloride T.S.,

Sarcolactic Acid.—or by 1 mil of copper sulphate T.S.

Heavy Metals.—An aqueous solution of the Acid does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Sugars.—Add a few drops of Lactic Acid to 10 mils of hot alkaline cupric tartrate V.S.; no red precipitate is produced.

Glycerin.—Add 1 mil of Lactic Acid, in drops, to 5 mils of ether, shaking it after each addition; the ether solution does not become even transiently turbid.

Organic Impurities.—Pour Lactic Acid carefully upon an equal volume of colorless, concentrated sulphuric acid contained in a clean test tube, and keep the temperature at 15° C. (59° F.); no dark colored zone develops at the line of contact upon standing for fifteen minutes.

Phosphoric, Tartaric, Citric, or Oxalic Acid.—No turbidity is produced on heating the Acid with an excess of lime water.

Assay.—Pour about 2.5 mils of Lactic Acid into a tared and stoppered 250-mil flask, weigh accurately, add 50 mils of normal potassium hydroxide V.S. and boil the liquid for twenty minutes. The residual titration of the boiling solution with normal sulphuric acid V.S., using phenolphthalein T.S. as indicator, shows not less than 85 per cent. nor more than 90 per cent. of $C_3H_6O_3$.

Each mil of normal potassium hydroxide V.S. used corresponds to 0.09005 Gm. of $C_3H_6O_3$ or lactic anhydrides calculated as $C_3H_6O_3$. Each gramme of Lactic Acid corresponds to not less than 9.44 mils nor more than 10.0 mils of normal potassium hydroxide V.S.

U. S. P. Preparation.—Syrupus Calcii Lactophosphatis.

N. F. Preparations.—Elixir Calcii Lactophosphatis; Elixir Glycerophosphatum Compositum; Elixir Pepsini et Rennini Compositum; Emulsum Olei Morrhuæ cum Calcii Lactophosphate.

Uses.—Lactic acid is chiefly used to form the lactates, which are believed to be more easily assimilated than most salts. It is rarely prescribed alone, but may be given in doses of one-half to three fluidrachms (2 to 12 mils), largely diluted.

SACCHARUM LACTIS. U. S. Sugar of Milk

[**Sacch. Lact.**—MILK SUGAR LACTOSE]

Lactose [$C_{12}H_{22}O_{11} + H_2O = 360.19$] obtained from the whey of cow's milk. Preserve it in tightly-closed containers.

Preparation.—Sugar of milk is prepared by the addition of diluted sulphuric acid to the whey of cow's milk, and by subsequent evaporation, the albuminous matter is coagulated; this is filtered out and the liquid set aside to crystallize. Animal charcoal is sometimes used to decolorize the solution.

Official Description.—Sugar of Milk occurs in white, hard, crystalline masses, or as a white powder, producing a gritty sensation on the tongue. It is permanent in the air. It readily absorbs odors.

Odor, Taste, and Reaction.—Odorless, and having a faintly sweet taste. An aqueous solution of Sugar of Milk (1 in 20) is neutral to litmus and is dextrorotatory.

Solubility.—One Gm. of Sugar of Milk dissolves in 4.9 mils of water at 25° C. (77° F.) also in 2.6 mils of boiling water; almost insoluble in alcohol; insoluble in chloroform or ether.

Tests for Identity.—The specific rotation $[\alpha]_D$ of Sugar of Milk, determined at 25°C. (77° F.) in a solution in distilled water, containing in 100 mils the equivalent of 10 Gm. and using a 200-mm. tube, is from +52.2° to +52.5° (see U. S. P., Test No. 21, Chapter LXII).

Add an equal volume of sodium hydroxide T.S. to 5 mils of a hot, saturated, aqueous solution of Sugar of Milk and gently warm the mixture; the liquid turns yellow and finally brownish-red. On the subsequent addition of a few drops of cupric sulphate T.S., a precipitate of cuprous oxide appears.

Incinerate about 1 Gm. of Sugar of Milk; not more than 0.1 per cent. of ash remains.

A solution of 3 Gm. of Sugar of Milk in 10 mils of boiling distilled water is odorless, clear, and colorless or at most faintly yellow.

Impurities and Tests for Impurities.—*Dextrin.*—Add 20 mils of alcohol (70 per cent. by volume) to 2 Gm. of Sugar of Milk in a fine powder, shake the mixture frequently during half an hour at 15° C. (59° F.) and then filter it. Ten mils of the filtrate remains clear after admixture with an equal volume of dehydrated alcohol.

Sucrose or Glucose.—This liquid, upon evaporation on a water bath, leaves not more than 0.03 Gm. of residue.

Heavy Metals.—An aqueous solution of Sugar of Milk (1 in 20) does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Starch.—On boiling about 1 Gm. of powdered Sugar of Milk with 50 mils of distilled water and cooling the solution, no blue color is produced upon the addition of one drop of iodine T.S.

U. S. P. Preparations.—Ferri Carbonas Saccharatus; Pulvis Ipecacuanhæ et Opii; Trituratio Elaterini.

N. F. Preparation.—Pepsinum Saccharatum.

Uses.—Sugar of milk is a useful diluent, and is largely used in medicine and pharmacy. The hardness of the crystals has been used as an assistance in securing thorough admixture of the ingredients in compound powders, by necessitating prolonged trituration.

FEL BOVIS. U. S. Oxgall

The fresh bile of the ox, *Bos taurus* Linné (Fam. *Bovidæ*).

Oxgall is of complex chemical composition, the most important constituents being about 3 per cent. each of the sodium salts of *glycocholic acid*, $C_{26}H_{43}O_6N$, and *taurocholic acid*, $C_{26}N_{45}O_7NS$; it also contains the bile-pigments *bilirubin* ($C_{32}H_{36}O_6N_4$) and *biliverdin* ($C_{32}H_{36}O_9N_4$), also *lecithin, cholesterin,* and other minor acids and pigments.

Official Description.—A brownish-green or dark green, somewhat viscid liquid. When Oxgall is shaken with water a frothy mixture is produced.

Odor, Taste, and Reaction.—Characteristic odor, and disagreeable, bitter taste. It is neutral or faintly alkaline to litmus.

Specific Gravity.—Specific gravity: 1.015 to 1.025 at 25° C. (77° F.).

Tests for Identity.—A mixture of 2 drops of Oxgall and 10 mils of water, when treated, first with a drop of a freshly prepared solution of 1 part of sugar in 4 parts of water, and afterwards with sulphuric acid, cautiously added, until the precipitate first formed is redissolved, gradually acquires a brownish-red color, changing successively to carmine, purple, and violet.

U. S. P. Preparation.—Extractum Fellis Bovis.

Uses.—Oxgall is not used so extensively as it was at one time. It is administered with the intention of supplying a deficiency of bile in the intestines, in certain indications. A powdered extract is now official, replacing the formerly official purified oxgall. Its usefulness is questionable. The dose is five to fifteen grains (0.32 to 1 Gm.).

CETACEUM. U. S. Spermaceti

[Cetac.]

A concrete, fatty substance, obtained from the head of the sperm whale, *Physeter macrocephalus* Linné (Fam. *Physeteridæ*).

Preparation.—Spermaceti is made by the forcible expression of the oleaginous compound found in the head of the sperm whale to separate the olein. The solid fat is termed *cetin*.

Spermaceti is a mixture of various fats. When recrystallized from alcohol, *cetin* is obtained, while the alcohol on evaporation deposits an oil, *cetin elain,* which when saponified yields *cetin elaic acid,* an acid resembling, but distinct from, oleic acid. The cetin which crystallizes out of the alcohol is essentially *cetyl palmitate,* $C_{16}H_{33}(C_{16}H_{31}O_2)$. There are small amounts of fats containing *stearic acid,* $C_{18}H_{36}O_2$, *myristic acid,* $C_{14}H_{28}O$, and *lauro stearic acid,* $C_{12}H_{24}O_2$, with the alcohol radicals corresponding to these acids.

Official Description.—Spermaceti occurs in white, somewhat translucent, slightly unctuous masses, with a scaly, crystalline fracture, and a pearly luster. It becomes yellowish in color and rancid on prolonged exposure to air.

Odor, Taste, and Reaction.—A very faint odor and a bland, mild taste. Its alcoholic solution is neutral or not more than slightly acid to moistened litmus paper.

Solubility.—It is insoluble in water and nearly so in cold alcohol; soluble in boiling alcohol, in ether, chloroform, carbon disulphide, or fixed or volatile oils; only slightly soluble in cold petroleum benzin.

Specific Gravity.—0.938 to 0.944 at 25° C. (77° F.) as determined by the method given under *Cera Flava.*

Tests for Identity.—It melts between 42° and 50° C. (107.6° and 122° F.).

Impurities and Tests for Impurities.—*Paraffin.*—It dissolves completely in 50 parts of boiling alcohol.

Stearic Acid.—Warm a mixture of about 1 Gm. of Spermaceti and 10 mils of ammonia water until the Spermaceti is melted, then shake it thoroughly in a stoppered vessel for a few minutes, cool and filter. The filtrate, upon supersaturation with hydrochloric acid, may become turbid, but yields no precipitate.

U. S. P. Preparation.—Unguentum Aquæ Rosæ.

Uses.—Spermaceti is one of the solid fatty substances employed to give consistency to cerates and ointments, as in the well-known ointment of rose water.

Official Product of the Class Pisces

OLEUM MORRHUÆ. U. S. Cod Liver Oil

[**Ol. Morrh.**—Oleum Jecoris Aselli]

A fixed oil obtained from the fresh livers of *Gadus morrhua* Linné and of other species of *Gadus* (Fam. *Gadidæ*). Preserve it in a cool place, in well-closed containers, which have been thoroughly dried before filling.

Preparation.—The best method of preparing cod liver oil is to heat the livers in a wooden tank by means of low pressure steam. The resulting mass is carefully drained—the livers themselves containing, besides oil, a considerable portion of watery fluid, which passes off with it in the form of emulsion and separates on standing. In the case of the finest varieties, the oil, which is made only in the winter months, is drawn off by taps from the bottom of the cooking tank, and then put into a cooling house to freeze. The solid frozen mass is put into canvas bags, and submitted, while at a low temperature, to severe pressure, whereby the pure oil is expressed. This constitutes the light oil of commerce.

Cod liver oil consists chiefly of olein. Palmitin and stearin are present in small proportions; minute traces of iodine, chlorine, bromine, phosphorus, and sulphur are found, but these are not in sufficient quantity to have any medicinal effect. Recent investigators assert that cod liver oil owes its virtues to the alkaloids *aselline* and *morrhuine,* associated with morrhuic, formic, butyric, and phosphoric acids. Preparations are upon the market containing these substances and free from any of the oil or oily constituents. Very valuable results have been claimed for these preparations. An alcoholic extract, *morrhuol,* made by shaking cod liver oil with alcohol and concentrating the product, is reported to have active virtues.

Official Description.—Cod Liver Oil is a pale yellow, thin, oily liquid.

Odor, Taste, and Reaction.—A peculiar, slightly fishy, but not rancid odor, and a fishy taste. Slightly acid to litmus.

Solubility.—It is slightly soluble in alcohol; soluble in ether, chloroform, carbon disulphide, or ethyl acetate.

Specific Gravity.—0.918 to 0.922 at 25° C. (77° F.).

A solution of 1 drop of the Oil in 1 mil of chloroform when shaken with 1 drop of sulphuric acid acquires a violet-red tint, gradually changing to reddish-brown.

Tests for Identity.—Allow 2 or 3 drops of fuming nitric acid (specific gravity about 1.44) to flow alongside of 10 or 15 drops of the Oil contained in a watch glass; a reddish or purplish color is produced at the zone of contact. On stirring the mixture with a glass rod, this color becomes bright rose-red (distinction from *seal oil,* which shows no change in color, and from *other fish oils,* which become blue).

Impurities and Tests for Impurities.—*Free Fatty Acids.*—Cod Liver Oil is only slightly acid to litmus paper which has been previously moistened with alcohol.

Saponification Value.—Not less than 180 nor more than 190 (see U. S. P., Test No. 9, Chapter LXII).

Iodine Value.—Not less than 140 nor more than 180 (see U. S. P., Test No. 8, Chapter LXII).

U. S. P. Preparation.—Emulsum Olei Morrhuæ.

N. F. Preparations.—Emulsum Olei Morrhuæ cum Calcii Lactophosphate; Emulsum Olei Morrhuæ cum Calcii Phosphate; Emulsum Olei Morrhuæ cum Malto; Emulsum Olei Morrhuæ cum Hypophosphitibus; Emulsum Olei Morrhuæ cum Pruno Virginiana; Emulsum Olei Morrhuæ cum Vitello.

Uses.—Cod liver oil is used as a nutrient and alterative in wasting diseases, notably phthisis. Dose, one to four fluidrachms (4 to 15 mils).

Official Products of the Class Insecta

CANTHARIS. U. S. Cantharides

[**Canthar.**—Spanish Flies Russian Flies]

The dried beetles, *Cantharis vesicatoria* (Linné) De Geer (Fam. *Meloideæ,* Order *Coleoptera*), yielding not less than 0.6 per cent. of cantharidin. Preserve Cantharides in tightly closed containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects.

Cantharides owe their blistering properties to *cantharidin,* $C_{10}H_{12}O_4$. This is a white substance, in the form of crystalline scales, of a shining micaceous appearance, inodorous, tasteless, almost insoluble in water and in cold alcohol, but soluble in acetone, ether, chloroform, benzene, formic and glacial acetic acids, the oils, and in hot alcohol, which deposits it upon cooling. It fuses between 210° and 212° C. (410° and 413.6° F.), is volatilizable by heat without decomposition, and its vapor condenses in acicular crystals. The subliming point of isolated cantharidin is 100° C. (212° F.), or the temperature of boiling water. Cantharidin is believed to be the anhydride or lactone of cantharidic acid, and is obtained from other beetles than the *C. vesicatoria,* especially the *mylabris cichorii.* The latter forms definite salts with bases. These may be obtained by heating cantharidin with alkaline solutions.

An assay has been appended to the U. S. P. IX text to indicate the cantharidin content. In the British Pharmacopœia,, cantharidin, obtained from any of the species of Cantharis or Mylabris, has replaced the drug, and all British preparations are made directly from cantharidin.

Official Description.—From 15 to 25 mm. in length, 5 to 8 mm. in breadth, oblong, somewhat compressed above; of a brilliant green or bluish-green, metallic luster, changing in different parts, especially beneath, to a golden-green; head triangular, separated into two lateral lobes by a faint median line; mandibles stout and partly concealed; antennæ filiform, of 11 conical joints, the upper ones being black; eyes comparatively small; prothorax angulate; legs with five tarsal joints; wings membranous and brownish; elytra or wing sheaths each with two parallel lines and finely wrinkled.

Cantharides with an ammoniacal odor must not be used.

The powder is grayish-brown, with shining green particles and a number of long, pointed, 1-celled hairs 0.5 mm. in length and 0.02 mm. in width.

Odor and Taste.—Odor strong, disagreeable; taste slight, afterwards acrid.

Tests for Identity and Purity.—Cantharides does not contain more than 10 per cent. of moisture.

Cantharides yields not more than 9 per cent. of ash.

Assay.—Introduce 15 Gm. of Cantharides, in No. 40 powder, into a stout bottle of not less than 250 mils capacity, add 150 mils of a mixture of benzene, two volumes, and purified petroleum benzin, one volume, and then add 2 mils of hydrochloric acid. Stopper the bottle tightly, shake it well, and allow it to stand about ten hours. Now gradually warm the bottle and its contents to about 40° C. (104° F.) and maintain it at that temperature with frequent shaking during three hours. Cool the mixture, decant or filter off 100 mils of the clear solution and evaporate this rapidly in a tared beaker or wide-necked flask to a volume of about 5 mils. Now add 5 mils of chloroform to the residue and set it aside in a moderately warm place. When the solvent has all evaporated, add to the crystals 10 mils of a mixture of equal volumes of dehydrated alcohol and purified petroleum benzin, which has previously been saturated with pure cantharidin, allow the mixture to stand during fifteen minutes and then decant the liquid through a pellet of purified cotton. Wash the crystals with successive portions of a saturated solution of cantharidin, similar to that directed above, until it is free from fat and coloring matter, and pass the washings through the same pellet of purified cotton. Then wash the cotton with a very small quantity of warm chloroform to dissolve any adhering crystals, collect the chloroform in the tared flask or beaker containing the washed crystals, evaporate the solvent with the aid of a blast of air, dry the crystals at 60° C. (140° F.) for one-half hour and weigh. The resulting weight will be the amount of cantharidin obtained from ten grammes of Cantharides.

U. S. P. Preparations.—Ceratum Cantharidis; Collodium Cantharidatum; Emplastrum Cantharidis; Tinctura Cantharidis.

Uses.—Cantharides are used as an aphrodisiac and are poisonous. When applied externally they produce vesication. Dose, one-half grain (0.03 Gm.).

COCCUS. U. S. Cochineal

The dried female of the insect *Coccus cacti* Linné (Fam. *Coccidæ*), enclosing the young larvæ.

Official Description.—Somewhat ovate in outline, convex above, concave beneath, from 3.5 to 5 mm. in length, consisting of from 9 to 12 segments; externally grayish-purple or grayish; in the shell-like, somewhat horny abdomen lie numerous larvæ less than 1 mm. in diameter; the mature larvæ with antennæ consisting of eight joints, 3 pairs of legs, the lower having from 6 to 8 segments, and a characteristic beak or rostrum composed of 4 thread-like parts which pair off into two coils.

Cochineal is easily pulverizable and yields a dark red powder.

Odor and Taste.—Characteristic odor and slightly bitter taste.

Solubility.—When masticated it colors the saliva red, due to the coloring principle, carminic acid, which is soluble in water, alcohol, or alkalies and slightly soluble in ether but insoluble in fixed or volatile oils.

Tests for Identity and Purity.—Alkalies change the color of solutions of Cochineal to purple, while acids change it to reddish-yellow. When Cochineal is macerated in water no insoluble powder separates.

Cochineal yields not more than 6 per cent. of ash.

U. S. P. Preparation.—Tinctura Cardamomi Composita.

N. F. Preparations.—Liquor Cocci; Syrupus Asari Compositus; Tinctura Kino et Opii Composita.

Cochineal owes its red color to *carminic acid* or *carmine-red,* $C_{11}H_{12}O_6 + 2H_2O$, which is present to the extent of 8 to 10 per cent. (see page 1471). This substance may be precipitated by most metallic salts; aluminum hydroxide forms what is termed a *lake.* It is very soluble in ammonia water and advantage is taken of these facts in preparing the N. F. solution of cochineal and carmines. It contains mucilage, fat, inorganic salts, etc.

Uses.—Its only use in pharmacy is to impart a bright red color to various preparations, like compound tincture of cardamom, elixirs, dentifrices, etc.

CERA FLAVA. U. S. Yellow Wax

[**Cer. Flav.**—BEESWAX]

A product obtained by melting and purifying the honey-comb of the bee, *Apis mellifera* Linné (Fam. *Apidæ*).

Preparation.—Wax is now known to be a peculiar secretion of bees. Yellow wax is obtained on the large scale by first abstracting the honey from the combs by shaving off the ends of the cells, draining, and then placing them in centrifugals. The honey is rapidly whirled out, water is added, and the wax is thoroughly and quickly cleaned; it is then melted and strained and run into flat dishes or moulds to cool and harden.

Beeswax is a mixture of three different substances, which may be separated from one another by alcohol—viz.: 1, *myrocin,* insoluble in boiling alcohol, and consisting chiefly of *myricyl palmitate,* $C_{30}H_{61}(C_{16}H_{31}O_2)$, which is a compound of *palmitic acid,* $C_{16}H_{32}O_2$, and *myricyl alcohol,* $C_{30}H_{62}O$; 2, *cerin* or *cerotic acid,* $C_{27}H_{54}O_2$ (formerly called *cerin* when obtained only in an impure state), which is dissolved by boiling alcohol, but crystallizes out on cooling; 3, *cerolein,* which remains dissolved in the cold alcoholic liquid. This latter is probably a mixture of fatty acids, as indicated by its acid reaction to litmus paper.

Official Description.—Yellow Wax is a yellow to gray-brown solid. It is somewhat brittle when cold, and when broken presents a dull, granular, not crystalline fracture. By the heat of the hand, it becomes plastic.

Odor and Taste.—Agreeable, honey-like odor, and a faint characteristic taste.

Solubility.—Yellow Wax is insoluble in water, sparingly soluble in cold alcohol; boiling alcohol dissolves the cerotic acid and a portion of the myrocin. It is completely soluble in chloroform, ether, or in fixed or volatile oils; partly soluble in cold benzene or carbon disulphide, and completely soluble in these liquids at a temperature of from 25° to 30° C. (77°–86° F.).

Specific Gravity.—0.950 to 0.960 at 25° C. (77° F.) determined as follows:

Melt the Wax at a low temperature and allow it to fall in separated drops from just above the surface into alcohol that has been warmed to from 45° to 50° C. (113°–122° F.). Allow the globules to remain in the alcohol until it has cooled spontaneously to room temperature (20° to 25° C.) (68°–77° F.), then remove the Wax and keep it at room temperature for 24 hours. Prepare a mixture of 4 volumes of alcohol and enough distilled water to make 10 volumes and allow it to stand until free from air bubbles. Moisten the globules of Wax with distilled water, by means of a brush, and place them by means of forceps in the alcohol solution just prepared contained in a beaker. Then add alcohol or air-free distilled water as required to the mixture, kept at 25° C. (77° F.), until the globules of Wax float or rest indifferently in the liquid, and finally determine the specific gravity of the alcoholic liquid. The figure thus obtained is the specific gravity of the Wax examined.

Tests for Identity.—It melts between 62° and 65° C. (143.6°–149° F.).

Impurities and Tests for Impurities.—*Fats or Fatty Acids, Japan Wax, or Rosin.*—Boil 1 Gm. of Yellow Wax for half an hour with 35 mils of an aqueous solution of sodium hydroxide (1 in 7), the volume being preserved by the occasional addition of distilled water; the Wax separates on cooling without rendering the liquid opaque, and no precipitate is produced in the liquid after filtration through glass wool or asbestos on the addition of hydrochloric acid in excess.

Soap.—Hydrochloric acid produces no precipitate in water which has been boiled with a portion of the Wax.

Acid Value.—Warm about 3 Gm. of Yellow Wax, accurately weighed, in a 200-mil flask with 25 mils of neutral dehydrated alcohol until melted, then add 1 mil of phenolphthalein T.S. and titrate the mixture while warm with half-normal alcoholic potassium hydroxide V.S. to a faint pink color. This figure so obtained is not less than 18 nor more than 24.

Ester Value.—Now add 25 mils of half-normal alcoholic potassium hydroxide V.S. and 50 mils of alcohol, boil the mixture for two hours under a reflux condenser and titrate the excess of the alkali with half-normal hydrochloric acid V.S. This figure so obtained is not less than 72 nor more than 77.

U. S. P. Preparations.—Ceratum Cantharidis; Ceratum Resinæ; Emplastrum Resinæ; Linimentum Terebinthinæ (from Rosin Cerate); Unguentum Picis Liquidæ.

N. F. Preparations.—Ceratum Resinæ Compositum; Emplastrum Fuscum Camphoratum; Mulla Creosoti Salicylata; Unguentum Picis Compositum; Unguentum Resorcinolis Compositum.

Uses.—Its use is chiefly to give consistence to fatty vehicles.

CERA ALBA. U. S. White Wax
[Cer. Alb.]

Yellow Wax, bleached.

Preparation.—The color of yellow wax is discharged by exposing it with an extended surface to the combined influence of air, light, and moisture. The process of bleaching is often conducted upon a large scale. The wax, previously melted, is made to fall in streams upon a revolving cylinder kept constantly wet, upon which it concretes, forming thin layers. These, having been removed, are spread upon linen cloths stretched on frames, and exposed to the air and light, care being taken to wet and occasionally turn them. In a few days they are partially bleached; but to deprive the wax completely of color it is necessary to repeat the whole process once, if not oftener. When sufficiently white, it is melted and cast into small circular cakes.

Official Description.—White Wax is a yellowish-white solid, somewhat translucent in thin layers; it is free from rancidity.

Odor and Taste.—Faint characteristic odor; nearly tasteless.

Solubility.—See *Cera Flava.*

Specific Gravity.—0.950 to 0.960 at 25° C. (77° F.), as determined by the method given under *Cera Flava.*

It melts between 62° and 65° C. (143.6°–149° F.).

Acid Value.—Not less than 17 nor more than 23.

Ester Value.—Not less than 72 nor more than 79, as determined by the method given under *Cera Flava.*

Tests for Identity and Purity.—In other respects White Wax has the characteristics of Yellow Wax and responds to the tests for identity and purity under *Cera Flava.*

U. S. P. Preparations.—Ceratum Unguentum; Unguentum Aquæ Rosæ.

N. F. Preparations.—Ceratum Camphoræ; Ceratum Plumbi Subacetatis; Petroxolinum Spissum; Unguentum Camphoræ.

Uses.—Wax is used in pharmacy principally to give consistence to cerates and ointments.

ACIDUM FORMICUM. N. F. Formic Acid
[Acid. Formic.]

An aqueous solution containing not less than 24 per cent. nor more than 26 per cent. of HCOOH (46.02).

Preparation.—It occurs free in ants, especially *Formica rufa,* from which its name is derived, also in other insects and the secretion of some animals. It is also prepared by oxidizing methyl alcohol, by the direct combination of CO and KOH at 100° C. (212° F.) and by other chemical processes. Commercially it is prepared by heating together 50 parts of glycerin and 50 parts of oxalic acid to 105° C. (221° F.), cooling to 50° C. (122° F.), again adding 50 parts of oxalic acid and then distilling at 115° C. (239° F.). The reaction is as follows:

$$\underset{\text{Oxalic Acid}}{H_2C_2O_4} + \underset{\text{Glycerin}}{C_3H_5(OH)_3} = \underset{\text{Glyceryl Monoformate}}{C_3H_5(OH)_2COOH} + \underset{\text{Carbon Dioxide}}{CO_2} + \underset{\text{Water}}{H_2O}$$

Then the water unites with the ester as follows:

$$\underset{\text{Glyceryl Monoformate}}{C_3H_5(OH)_2COOH} + \underset{\text{Water}}{H_2O} = \underset{\text{Glycerin}}{C_3H_5(OH)_3} + \underset{\text{Formic Acid}}{HCOOH}$$

Official Description.—Formic Acid is a clear, colorless liquid.

Odor and Reaction.—Strongly acid reaction and a characteristic pungent odor.

Specific Gravity.—About 1.058 at 25° C. (77° F.).

Solubility.—It is miscible with water or alcohol.

Tests for Identity.—Formic Acid is volatilized on heating, and on evaporating 20 mils to dryness on a water bath, not more than 0.002 Gm. of residue remains.

A white precipitate of mercurous chloride is formed on warming Formic Acid with mercuric chloride T.S.

Impurities and Tests for Impurities.—*Chloride.*—When Formic Acid is diluted with five times its volume of distilled water, separate portions yield no precipitate or turbidity on the addition of silver nitrate T.S. after adding nitric acid,

Sulphate.—or barium chloride T.S.,

Oxalic Acid.—or calcium chloride T.S. after supersaturating with ammonia water.

Acorlein, Allyl Formate.—When supersaturated with solution of sodium hydroxide, Formic Acid develops no pungent or empyreumatic odor.

Acetic Acid.—Heat 1 mil of Formic Acid on a water bath with 1.5 Gm. of yellow mercuric oxide and 10 mils of distilled water for ten minutes and filter the liquid; the filtrate does not show an acid reaction.

Sulphurous Acid.—Add 1 drop of tenth-normal iodine V.S. to 10 mils of Formic Acid; the iodine color is not destroyed.

Heavy Metals.—Formic Acid does not respond to the Test for heavy metals (see U. S. P., Test No. 3, Chapter LXII).

Assay.—Pour about 5 mils of Formic Acid into a weighing bottle, stopper, weigh accurately, dilute with about 50 mils of distilled water and titrate with normal potassium hydroxide V.S., using phenolphthalein T.S. as indicator. It shows not less than 24 per cent. nor more than 26 per cent. of HCOOH.

Each mil of normal potassium hydroxide V.S. used corresponds to 0.04602 Gm. of HCOOH. Each gramme of Formic Acid corresponds to not less than 5.2 mils nor more than 5.65 mils of normal potassium hydroxide T.S.

N. F. Preparations.—Elixir Formatum; Elixir Formatum Compositum; Spiritus Acidi Formici.

Uses.—It was introduced into the N. F. chiefly to produce the alkaline formates for making syrups and elixirs, but it has been used as an irritant and vesicant when applied locally—and virtually as a stimulant, like ammonia, in a dose of five minims (0.3 mil).

CARMINUM. N. F. Carmine

[Carmin.]

The aluminum lake of the coloring principle obtained from cochineal. Preserve it in well-stoppered, amber-colored bottles, protected from light.

Preparation.—It is prepared from cochineal (see *Coccus,* page 1468).

Official Description.—It occurs in irregular, angular, bright red fragments or as a powder. When burned, Carmine emits an odor resembling that of burned feathers.

Odor and Taste.—Without odor or taste.

Solubility.—Slightly soluble in water to which it imparts a red color; freely soluble n ammonia water and alkaline liquids, forming a dark purplish-red solution.

Tests for Identity.—The yield of ash does not exceed 12 per cent.

Impurities and Tests for Impurities.—*Tin, Lead, and Soluble Barium Compounds.*—Fuse the ash of 1 Gm. of Carmine with 1 Gm. of sodium cyanide, dissolve the fused mass in hydrochloric acid with the addition of a few drops of nitric acid, then dilute it with distilled water to 30 mils and filter the solution. Separate portions of 10 mils each of this solution yield no precipitate with hydrogen sulphide T.S. or with sulphuric acid.

Barium Sulphate.—Fuse the ash from 1 Gm. of Carmine with a mixture of 1 Gm. of sodium cyanide and 1 Gm. of potassium carbonate, extract the fused mass with boiling distilled water, filter, wash with hot distilled water and dissolve the residue in diluted hydrochloric acid; this solution does not become turbid on the addition of a few drops of sulphuric acid.

N. F. Preparations.—Liquor Carmini; Trochisci Phenolphthaleinum.

Uses.—It is used exclusively as a red coloring substance. Often used in dental preparations, ointments, and in making cakes and candies. To obtain the maximum color value from the carmine, it should be dissolved in a small amount of strong ammonia water and the solution triturated with the powder to be colored, or, preferably, the N. F. solution may be used.

LIQUOR CARMINI. N. F. Solution of Carmine

[Liq. Carmin.]

	Metric	Old form
Carmine	65 Gm.	2 oz. av. 35 gr.
Ammonia Water	365 mils	11 fl. oz. 326 min.
Glycerin	365 mils	11 fl. oz. 326 min.
Water, a sufficient quantity,		
To make	1000 mils	2 pints

Triturate the carmine to a fine powder, gradually add the ammonia water, and afterwards the glycerin, with constant trituration. Transfer the mixture to a porcelain dish and heat it on a water bath, constantly stirring, until the liquid is entirely free from ammoniacal odor. Then cool the liquid and add sufficient water to make the finished product measure 1000 mils [old form 2 pints].

LIQUOR COCCI. N. F. Cochineal Color

[Liq. Cocci—Liquor Coccineus, N.F. III]

	Metric	Old form
Cochineal, in No. 50 powder	65 Gm.	2 oz. av. 35 gr.
Potassium Carbonate	32 Gm.	1 oz. av. 11 gr.
Alum	32 Gm.	1 oz. av. 11 gr.
Potassium Bitartrate	65 Gm.	2 oz. av. 35 gr.
Glycerin	500 mils	16 fl. oz.
Alcohol	32 mils	1 fl. oz. 12 min.
Water, a sufficient quantity,		
To make	1000 mils	2 pints

Triturate the cochineal intimately with the potassium carbonate, then add 500 mils [old form 1 pint] of water, followed by the alum and potassium bitartrate, successively. Heat the mixture to boiling in a capacious vessel, set it aside to cool, then add the glycerin and alcohol and filter the mixture, passing enough water through the filter to make the finished product measure 1000 mils [old form 2 pints].

EXTRACTUM CARNIS. N. F. Extract of Beef
[**Ext. Carnis**—BEEF EXTRACT]

The residue obtained from fresh beef broth by evaporation at a low temperature.

Preparation.—The solid extract of beef, which is recognized by the N. F., usually known as the "Liebig type," is made by chopping fresh lean beef, cooking it with boiling water, straining, cooling, and separating fat and gelatin from the liquid. Finally this aqueous extract is evaporated to a soft mass in a vacuum apparatus. The yield from beef is from 2 to 3 per cent., one ounce of the extract representing about two pounds of beef. Beef extract of good quality contains the important nitrogenous bases, *creatine, creatinine, xanthine, sarkine,* and *carnine,* and the N. F. provides a test for the amount of nitrogen obtainable.

Official Description.—A yellowish-brown to dark brown, pasty mass.

Odor, Taste, and Reaction.—Agreeable meat-like odor and taste; slightly acid.

Solubility.—Twenty-five Gm. of Extract of Beef, diluted to 250 mils with distilled water, yields a nearly clear solution, free from sediment. Separate portions of this solution respond to the following tests:

Tests for Identity and Purity.—*Nitrate.*—Boil 10 mils of the solution for one minute with 1.5 Gm. of purified animal charcoal, add distilled water to replace that lost by evaporation and filter; the filtrate produces no blue coloration when one drop is added to three drops of a solution of diphenylamine (1 in 100) in concentrated sulphuric acid.

Distribute 10 mils of the solution over dry sand or asbestos and dry to constant weight in a flat-bottomed porcelain dish in an oven at a temperature of 105° C. (221° F.); it yields a residue of not less than 0.75 Gm., equivalent to 75 per cent. of solids in the original extract.

Sodium Chloride.—Incinerate the residue from 10 mils of the solution obtained in the preceding test; the ash does not exceed 30 per cent. of the residue, nor does the sodium chloride in the ash exceed 10 per cent. of the residue when determined as directed under the Assay for chlorides (see U. S. P., Test No. 5, Chapter. LXII).

To 100 mils of the solution contained in a 500-mil Kjeldahl flask, add 5 Gm. of barium carbonate and 100 mils of distilled water and, using a connecting bulb, distil 100 mils into 10 mils of half-normal hydrochloric acid V.S. Titrate the excess of acid, using cochineal T.S. as indicator, and from the acid consumed by the distillate, calculate the percentage of nitrogen as ammonia. This does not exceed 0.35 per cent. of the total solids.

Transfer 25 mils of the solution to a 100-mil Erlenmeyer flask, add 50 mils of alcohol and shake the mixture thoroughly. When the precipitate has subsided, filter, collect the precipitate upon a 9-cm. counterpoised filter, wash the precipitate three times with a mixture of two volumes of alcohol and one volume of distilled water and then dry it to constant weight at 105° C. (221° F.). The weight of this precipitate does not exceed 10 per cent. of the total solids. (Reserve the filtrate and washing for the following determination of nitrogen.)

Nitrogen.—To an aliquot portion of the alcoholic filtrate from the preceding test, corresponding to 1 Gm. of the alcohol soluble solids, add 4 mils of sulphuric acid and evaporate to dryness in a 500-mil Kjeldahl flask. Determine the nitrogen by the Gunning-Kjeldahl method. The amount of nitrogen thus found is not less than 0.06 Gm.

N. F. Preparations.—Vinum Carnis; Vinum Carnis et Ferri.

Uses.—It is a stimulant, but has little nutritive value. Used in the N. F. wines and largely as a food and tonic.

LAC VACCINUM. N. F. **Cow's Milk**

The fresh milk of the domestic cow, *Bos taurus* Linné (Fam. *Bovidæ*), without modification, and complying with the legal standards of the State or community in which it is sold.

N. F. Preparation.—Lac Fermentatum.

Uses.—Milk is recognized by the N. F. solely for the preparation of fermented milk (see below). Milk is marketed and sold in most states under rigid regulations concerning the health of the cows, the transportation conditions for the milk and the contents of fat and total solids. It is also largely sold in cans as *condensed milk,* a product obtained by evaporating whole milk or partially skimmed milk in vacuum and preserving it with cane sugar, and also as *evaporated milk,* obtained by evaporating whole milk without adding sugar and preserving it by sterilization. Another commercial form is known as *desiccated milk* or *milk powder.* It is largely used by bakers and confectioners and in the manufacture of ice cream. It is a dry powder, which readily absorbs moisture, and is made by forcing either skimmed milk or the whole milk, in the form of a spray, into a closet of heated air and collecting the dry milk particles against a screen or by drying the milk on heated cylinders and scraping off the thin film of milk as it dries.

LAC FERMENTATUM. N. F. **Fermented Milk**

[Lac. Ferment.—Kumyss]

	Metric	Old Form
Cow's Milk	**1000 mils**	**2 pints**
Compressed Yeast	**3 Gm.**	**45 gr.**
Sugar	**35 Gm.**	**1 oz. av. 87½ gr.**

Dissolve the sugar in the milk, contained in a strong bottle, add the yeast, close the bottle securely and keep it at a temperature between 23° and 32° C. (73.4° and 89.6° F.) for six hours; then transfer it to a cool place, preferably a refrigerator.

Milk, fermented by the lactic acid bacillus, has recently had a large use, due to the researches and publications of Metschnikoff, who claims that such bacilli prevent putrefactive changes in the alimentary canal. Fermented milk has been known for many years. Under the name *Kefir* it was used by the Turks and Tartars, the fermentation being started by lactic acid bacilli and yeast cells. It has also been known as *Kumyss* or *Koumyss,* originally made from mare's milk. *Matzoon,* a similar preparation, was made in Armenia from the milk of buffaloes and goats, and other names have been applied in other countries to related products.

The investigations of Metschnikoff showed that the most energetic lactic acid producing bacilli was *bacillus lactis bulgaricus,* often called *Bulgarian bacillus,* and this is now marketed in *tablet* form or in vials suitable for the preparation of the fermented milk or for internal administration. Various strains of lactic acid bacilli are used to prepare milk drinks which resemble buttermilk.

Uses.—Through the production of lactic acid it tends to restrain the growth of putrefactive organisms in the lower bowel, and is used in such diseases as are due to intestinal fermentation.

OVUM GALLINACEUM. N. F. Fresh Egg
[Ovum Gallin.]

The recently laid egg of the hen, *Gallus domesticus* Temminck (Fam. *Phasianidæ*).

N. F. Preparation.—Linimentum Terebinthinæ Aceticum.

OVI ALBUMEN RECENS. N. F. Fresh Egg Albumen
[Ovi Album.]

The freshly separated liquid white, or albumen, of recently laid eggs of the hen, *Gallus domesticus* Temminck (Fam. *Phasianidæ*). It is composed of about 85 per cent. of water, the remainder being solid matter, chiefly a proteid compound with minute amounts of fat, sugar, and inorganic salts. It is precipitated by most acids (phosphoric and acetic being exceptions) and coagulated by alcohol, heat, tannin, phenol, camphor, etc. It forms precipitates with the salts of most heavy metals and is therefore a valuable antidote in poisoning by mercury, copper and other salts. It is used officially chiefly in preparing the albuminates and peptonate of iron.

N. F. Preparations.—Linimentum Opii Compositum; Liquor Ferri Albuminati; Liquor Ferri Peptonati; Liquor Ferri Peptonati et Mangani.

OVI VITELLUM RECENS. N. F. Fresh Egg Yolk
[Ovi Vitel.]

The freshly separated yolk of recently laid eggs of the hen, *Gallus domesticus* Temminck (Fam. *Phasianidæ*). It is a viscid, yellowish liquid and consists of fatty substances, chiefly olein and margarin, which are emulsified by a proteid called *vitellin.* It also contains inorganic salts, coloring matter, *cholesterin* and *lecithin.*

N. F. Preparations.—Emulsum Olei Morrhuæ Cum Vitello; Glyceritum Vitelli.

Uses.—It is used pharmaceutically as an emulsifying agent.

RENNINUM. N. F. Rennin

The partially purified milk-curdling enzyme obtained from the glandular layer of the stomach of the calf, *Bos taurus* Linné (Fam. *Bovidæ*), and capable of coagulating not less than 25,000 times its weight of fresh milk. Rennin of a higher coagulating power may be brought to the standard by admixture with sodium chloride and sugar of milk. Rennin deteriorates rapidly and must be kept in well-stoppered, amber-colored bottles, and stored in a cool place.

Preparation.—It is usually prepared by digesting the mucus membrane of calves' stomachs for twenty-four hours in a one-half per cent. sodium chloride solution, filtering, then adding hydrochloric acid to the filtrate to make one per cent. acid, again filtering and saturating the filtrate with sodium chloride. On standing, the enzyme separates as a white flocculent mass and is carefully dried.

Official Description.—Rennin occurs as a grayish-white or yellowish-white powder, or as pale yellow grains or scales. It is slightly hygroscopic.

Odor and Taste.—Characteristic and slightly saline taste and a peculiar, not unpleasant odor.

Solubility.—It is slowly soluble in water and in diluted alcohol, the solutions being more or less opalescent.

Tests for Identity.—When mounted in water or diluted alcohol and examined microscopically, it shows no cellular structure, and no blue coloration is produced on the addition of iodine T.S.

Assay.—Mix 0.1 Gm. of Rennin with 50 mils of distilled water by stirring (vigorous shaking or violent agitation of this liquid must be avoided) and allow the liquid to stand for exactly fifteen minutes. Place 50 mils of cow's milk in a beaker about 12 cm. in height and 5 cm. in width, warm rapidly on a water bath to 43° C. (109.4° F.), add 1 mil of the Rennin solution and stir the mixture slowly for ten seconds. Maintain the temperature of the bath at 43°C. (109.4° F.) for ten minutes after the addition of the Rennin solution, remove the beaker from the bath and tip it to an angle of 45 degrees. The milk must have lost its fluidity to the extent of exhibiting a decidedly convex surface. An additional thirty seconds on the water bath produces a firm curd.

N. F. Preparation.—Elixir Pepsini et Rennini Compositum.

Uses.—It is used to produce a curd in milk, oftentimes for a food called *junket,* also as a digestant. The form in which it is usually sold is called "Essence of Pepsin" (see page 418) or as *junket tablets* or a preparation called *liquid rennet.*

QUESTIONS ON PRODUCTS FROM ANIMAL SUBSTANCES

Where are protein compounds found? (See page 1438.)
What are their constituents?
What are their physical properties?
Mention some of the more important protein substances.
How may they be decomposed and what is the resulting product?
What are ptomaines? What are leucomaines? What are toxalbumins?
From what classes are the animal products which are of interest in pharmacy derived?
Lard—What is the Latin name? What is its source?
How is it prepared?
What is the process, used largely in France, of purifying lard?
Give description, odor, taste, chemical reaction, solubility, specific gravity, and tests for identity.
How may the following impurities be detected?—viz.: Alkalies; chlorides; free fatty acids; cottonseed fats; beef stearin.
Of what does lard consist?
To what is its consistence due?
For what is lard used in pharmacy?
What is lard oil? How is it prepared?
Benzoinated lard—What is the Latin official name?
How is it prepared? What temperature should be used?
If the weather is warm what addition is permitted?
Does the method of adding tincture of benzoin to lard and mixing make as good a product as the official method? Why? In what official preparations is benzoinated lard used?
Wool fat—What is the Latin title? Give definition. What is a common name?
How is it obtained? What is "suint"? Of what does it consist?
Give description, odor, taste, chemical reaction, and tests for identity and purity.
For what is it used?
Hydrous wool fat—What is its Latin title? How much water may it contain?
Give description, odor, chemical reaction, solubility, and tests for identity.
For what is it used? What is its special advantage?

Prepared suet—What is the Latin official name? What is its source and how prepared?
Give description, odor, taste, specific gravity, and solubility. Give tests for identity and purity.
For what is it used?
Benzoinated suet—How is it prepared?
What are its advantages over prepared suet.
Gelatin—What is gelatin? What is impure gelatin called? How is it obtained and purified? What is "shred gelatin"? "Powdered gelatin"? "Ground gelatin"?
Give description, odor, taste, solubility, and tests for identity and purity. What amount of sulphur dioxide is permitted in gelatin for ordinary use?
How much is permitted for making capsules?
For what is it used in pharmacy? Give the official preparation.
What is pepsin, and whence obtained?
How much coagulated egg albumen should it be capable of digesting?
Describe Prof. Scheffer's process for making it.
How is purified pepsin or scaly pepsin prepared? What is granular pepsin? What is "spongy pepsin" and how is it made? What is insoluble pepsin and what are its uses?
Give description, odor, taste, specific gravity, and solubility. Give tests for identity.
How may it be assayed? Give the details.
What is the dose?
Saccharated pepsin—How is it prepared? How much pepsin does it contain?
Solution of pepsin—How much pepsin does it represent? Give the process.
Antiseptic solution of pepsin—What are the constituents? How is it used medicinally?
Aromatic solution of pepsin—Name the constituents. What are its uses and the dose?
Lime juice and pepsin—How is it prepared?
Pancreatin—What is the official definition? Of what does it consist?
How many times its own weight of starch should it render soluble in water?
How is it prepared?
What effect does it have upon the following: starch; proteins? What effect do acids have upon it?
Give description, odor, taste, solubility, and tests for identity. Describe the assay.
For what is it used in medicine? Give the dose.
Solution of pancreatin—What are the synonyms?
How is it prepared?
Dried suprarenals—What is the Latin title? Give the synonyms. What is its source?
What is the U. S. P. standard? How may it be prepared? Name the active, alkaloidal principle which it contains.
Give description, odor, solubility, and tests for identity. For what is it used? How may it be assayed?
Describe adrenalin. What is its chemical name? How is it prepared?
How is adrenalin used? What is its action?
Dried thyroids—Give the synonym.
What is the source and how prepared?
What is the active constituent and what is the U. S. P. standard?
Describe its appearance and odor. How is it assayed?
What are its uses and the dose?
Desiccated hypophysis—Give the Latin title. What is the synonym?
What is this drug? Describe it.
How is it obtained?
Give its uses and the dose.
Solution of hypophysis—Give Latin title and synonym.
How is it prepared? What is the U. S. P. standard and how is this determined?
What are its advantages and uses?
Antitonic serums—What are these products and upon what principles do they depend for their therapeutic action?
What is meant by "passive immunity"? By "active immunity"?
Describe the three forms of serum which are official.

Antidiptheric serum—What is its synonym? How is it defined? At what temperature and under what conditions should it be preserved? How is it prepared and standardized? Describe the serum. What preservations may be used? What is the immunity dose? The curative dose?
Purified antidiphtheric serum—What are its synonyms? What is this substance? What is the dose?
Dried antidiphtheric serum—How is this product obtained? What precautions are necessary in preserving and using it? Describe the product.
Antitetanic serum—What is the synonym? How is it prepared? What are its uses and dose?
Purified antitetanic serum—What are the synonyms? How is it prepared?
Describe the product.
Dried antitetanic serum—How is it prepared? What precautions are necessary in using it?
Name the unofficial serums and the use of each.
Vaccine virus—Give the Latin title and synonyms. What is this substance? How is it prepared? How should it be preserved? What occurs if it is subjected to heat, even body temperature?
What are bacterins? Explain the principle of their action. What are "autogenous vaccines"?
What are "stock vaccines"? What are "serobacterins"?
Name the more important bacterins.
What is tuberculin?
Musk—What is the Latin official name? Give the synonyms. How is it officially described? What is its source?
What does it contain? What are its uses and the dose? What is its official preparation?
Lactic acid—How much absolute acid is represented, free and as anhydrides? What is its chemical name?
How may it be made?
Give description, odor, taste, specific gravity, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Chloride; sulphate sarcolactic acid; heavy metals; sugars; glycerin; organic impurities; phosphoric, tartaric, citric, or oxalic acid. For what is it used?
Sugar of milk—What is the Latin name? What are the synonyms?
How is it prepared?
Give description, odor, taste, specific gravity, and solubility. Give tests for identity.
How may the presence of dextrin, sucrose, glucose, or heavy metals be detected?
What are its uses? Why is it specially useful in pharmacy?
Oxgall—What is the Latin official name? What is the official definition? What are its constituents?
Describe appearance, odor, taste, chemical reaction, specific gravity, and test for identity.
For what is it used? What preparation is official?
Spermaceti—What is the Latin official name? How is it defined?
Give description and specific gravity.
Describe odor, taste, chemical reaction, solubility, test for identity, and presence of paraffin or stearic acid as an impurity.
How is it made?
What is its composition? For what is it used?
What class of official preparations does it enter?
Cod liver oil—What is the Latin official name? What is its synonym? What is its source?
How is it best prepared?
How is the light oil of commerce prepared?
What are its constituents? Give description and specific gravity.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may free fatty acids be detected? What is its saponification and iodine value?
What is its use and dose? Name its official preparation.
Cantharides—What is the Latin name? What are its synonyms?
Give the official definition and description.

To what do cantharides owe their blistering properties?
Describe the physical properties of cantharidin.
What is cantharidin believed to be chemically?
Does this acid form salts? How may they be obtained?
What is the most satisfactory test of cantharidin?
What are the medicinal properties of cantharides?
Name its official preparations.
Cochineal—What is the Latin name? What is its definition and description?
What does it contain?
To what does it owe its red color?
For what is it used?
Yellow wax—What is the Latin official name? What is its source?
What is wax? How is it obtained commercially?
What are the constituents of beeswax?
Which of these is soluble in alcohol?
Give description, odor, taste, chemical reaction, solubility, specific gravity, tests for identity, and saponification value.
How may the following impurities be detected?—viz.: Fats or fatty acids; Japan wax; rosin; soap. What are its uses?
White wax—What is the Latin title?
How is white wax made? What is its specific gravity?
Describe appearance, odor, taste, and tests for identity.
What is its principal use in pharmacy?
Formic acid—What is the strength of this acid?
How may it be prepared?
Describe the acid—What impurities are likely to be present and how detected?
What are its uses and the dose?
In what official preparations is it used?
Carmine—What is this substance and how obtained?
Describe it and give tests for identity and purity.
What are its solubilities? For what is it used?
Solution of carmine—How is it made?
Cochineal color—How is this solution prepared?
Extract of beef—What is the Latin title? How is it defined? Describe its preparation. What constituents should be present? Describe its appearance, odor, taste, reaction, and solubilities. What preparations are official? What are its uses?
Cow's milk—What is the Latin title? How is it defined?
Describe the various forms of commercial milk.
Fermented milk—What is the Latin title and synonym?
How is it prepared? What are its uses?
What is kefir? Matzoon? Bulgarian bacillus?
How are these substances used?
Fresh egg—How is it defined? What are its official uses?
Fresh egg albumen—What is the Latin title?
How is it defined? What are its characteristics and uses? In what official preparations is it used?
Fresh egg yolk—What is the Latin title?
How is it defined? What are its constituents and uses?
Rennin—What is this substance?
What standard is required? How is it obtained? Describe the enzyme.
How may it be assayed? What are its uses?

Unofficial Animal Products and Derivatives

Class Mammalia

Acidum Butyricum, $C_4H_8O_2$ Butyric Acid	A colorless liquid, having a disagreeable odor and a rancid taste. Density, 0.973
Ambra Grisea Ambergris	A morbid excretion from the intestines of *Physeter macrocephalus*, found floating on the sea. It is friable when cold, of a gray or brown-gray color. It contains 85 per cent. of ambrein, etc. Used in perfumery
Argenti Lactas, $Ag.C_3H_5O_3 + H_2O$	The normal silver salt of lactic acid. An astringent antiseptic, having about twice the power of mercuric chloride. It is irritating if applied in substance to wounds. Used in 1 : 100 to 1 : 2000 solutions
Argonin	Silver-casein. A white powder containing from 4 to 25 per cent. of silver. Used as injection in 2 to 5 per cent. solutions
Argyrol	A combination of silver oxide and protein; contains from 20 to 25 per cent. of silver. It occurs in plates, soluble in water; astringent and bactericide, not caustic. Used in 10 to 50 per cent. solution in cases of gonorrhea, conjunctivitis and in affections of nose and throat.
Sanguis **Blood**	The arterial fluid of the ox, *Bos taurus*. It is of a red color, opaque, and has a peculiar odor. It contains 78 per cent. of water, 8 per cent. of albumen, 5 per cent. of fibrin, etc. The red color is due to *hæmoglobin*
Butyrum **Butter**	From the milk of the cow, *Bos taurus*. Obtained by allowing the cream to separate from the milk, collecting and churning. A soft, yellow, neutral substance, of a pleasant, sweet odor and a bland taste. It contains 30 per cent. of olein, and about 68 per cent. of palmitin and stearin, etc.
Cargentos	A preparation of silver containing enough modified casein to maintain the silver in solution. It contains about 50 per cent. silver. Bactericide. Used in from 5 to 50 per cent. solutions
Castoreum **Castor**	From the preputial follicles of both the male and female animals *Castor Fiber*. The follicles occur in pairs, are pyriform, of a brown or blackish color, a peculiar odor, and a bitter, acrid, and nauseous taste. It contains a volatile oil, and from 15 to 40 per cent. of a bitterish, resinous substance, etc.
Civetta **Civet**	An odorous substance obtained from two animals of the genus *Viverra* which inhabit the East Indies. It is semi-solid, unctuous, yellowish, becoming brown and thicker by exposure to air; of a very strong, peculiar odor and a bitterish, acrid, and nauseous taste. It contains volatile oil, and resinous and other matters. Used in perfumery
Corpus Luteum (Desiccated)	Prepared by separating the yellow granular material from the corpora lutea from cow's ovaries and drying it at a low temperature. It is used in controlling the symptoms following the removal of the ovaries and the nervous disturbances incidental to the menopause. Dose, five grains (0.32 Gm.)
Collargolum Argentum Credé	Colloidal or soluble silver. Dose, one to two grains (0.065 to 0.13 Gm.)
Fibrin	Obtained when blood is allowed to coagulate or is whipped with a bundle of twigs. It is at first, when pure, a gelatinous mass, which changes to a white, tenacious material, consisting of minute fibrils
Hæmoglobin	The coloring matter of the red blood corpuscles combined with iron. Used as a substitute for iron in the treatment of anæmia. It consists of protein, globulin, and hematin. Dose, one and one-half grains (0.1 Gm.)
Hæmogallol Hæmoglobin, (deoxidized by pyrogallol)	A combination of iron with the hæmoglobin of blood; a compound which is easily assimilated. In the form of an insoluble and tasteless red-brown powder. Given in doses of four to eight grains (0.25 to 0.5 Gm.) for anæmia, convalescence, etc.
Hæmol	A blood preparation containing iron
Hyraceum	The product of *Hyrax capensis*, an animal of Southern Africa. It is found on the rugged sides of mountains, and is supposed to be the excrement or the dried urine of the animal. It is rather hard, tenacious, of a blackish-brown color, and of a taste and smell similar to those of castor
Keratin	The organic basis of horny tissues, hair, nails, feathers, epithelium, etc. It has been used for coating pills so as to enable them to pass through the acid juices of the stomach and be dissolved in the alkaline intestinal fluids, but has been largely discredited
Mammary Substance	The mammary gland of the sheep, cleaned, dried, and powdered. Used in profuse menstruation. Dose, two to five grains (0.13–0.32 Gm.)
Milk Casein	The most abundant of the albuminoids obtained from milk by the addition of rennet
Neat's-foot Oil	Prepared by boiling the feet of cattle, deprived of their hoofs, with water, removing the oil which rises to the surface, and allowing it to remain for some time in warm water. Used for softening leather
Novargan Argenti Proteinas	An organic silver-albumin compound containing 10 per cent. of silver. It occurs in fine yellow powder, soluble in water. It is a bactericide and less irritating than other protein-silver compounds. Used in gonorrhea, especially as an abortive in the first stage. Dose, 8 minims (0.5 mil) of a 15 per cent. solution
Ovarian Substance	The entire fresh ovaries of the hog, cleaned, dried, and powdered
Paraglobulin	Obtained from blood serum, lymph, chyle, etc. It is a granular substance, gradually becoming more compact
Parathyroid Gland (Desiccated)	The exterior parathyroids of the ox, cleaned, dried, and powdered. Used in gastric tetany, paralysis agitans, and chorea. Dose, one-tenth grain (0.006 Gm.)
Peptones	The product of the action of gastric and pancreatic juices, or of pepsin alone, upon albuminoids during the process of digestion

Unofficial Animal Products and Derivatives—*Continued*

Pineal Gland (Desiccated)	The pineal gland of normal young cattle, cleaned, dried, and powdered. Dose, one-tenth grain (0.006 Gm.)
Ptomaines Cadaveric alkaloids	Alkaloidal substances found in dead bodies or decomposed animal matter, as *choline, muscarine, neurine, gadinine, tetanine, dimethylamine, trimethylamine, triethylamine, putrescine, cadaverine, saprine, neuridine, collidine, hydrocollidine, parvoline,* and *tyrotoxicon* (*diabenzene*), etc.
Ptyalin	A fermentative substance occurring in saliva, and having the power of converting starch into dextrin
Sodii Choleas Sodium Choleate	Prepared by evaporating fresh oxgall to one-half, and precipitating the slimy and coloring matters with an equal bulk of alcohol, treating the filtrate with animal charcoal, distilling off the alcohol, and washing the residue with ether. It occurs as a white, sticky mass, having a penetrating odor, and a peculiar, sweetish, afterwards bitter taste. (See Fel Bovis)
Sophol	A compound of silver and methylene-nucleinic acid, the silver being in organic or masked form. A bactericide used in eye affections. Dose from 2 to 5 per cent. solutions
Thymus Gland (Desiccated)	Prepared by drying the thymus gland obtained from healthy domestic animals. It is used much like the thyroid in the treatment of exophthalmic goitre, also in rickets, marasmus, and related diseases. Dose, two to four grains (0.13–0.25 Gm.)
Urea Carbamide, $CO(NH_2)_2$	A hydragogue diuretic. Dose, ten grains (0.65 Gm.) every six hours
Sperm Oil	From the cranial cavities of *Physeter macrocephalus.* It is of a yellow or brown-yellow color. Sp. gr. 0.920. On cooling, it deposits spermaceti and stearin
Whale Oil	From *Balæna mysticetus.* It has a peculiar fishy odor and unpleasant taste
Porpoise Oil	From *Delphinus Phocœna.* Prepared by heating the belly-blubber of the porpoise. It is, when fresh, of a pale yellow color
Seal Oil	From *Phoca* of various species
Dugong Oil	From *Halicore Dugong.* Habitat, waters of Eastern Australia. This oil is generally used as a substitute for cod liver oil in Australia
Class Pisces	
Eulachon Oil	From *Thaleichthys Pacificus,* a small fish found on the Pacific coast. This oil has been proposed as a substitute for cod liver oil
Gaduol (Morrhuol)	Alcoholic extract of cod liver oil. Brownish-yellow, oily liquid of a bitter, acrid taste. Used like cod liver oil, prepared in wine or elixirs, in doses of five to thirty minims (0.3 to 2 mils)
Ichthyocolla Isinglass. U. S. P. 1890	The swimming bladder of *Acipenser Huso* Linné, and of other species of *Acipenser* (order *Sturiones*). Used in making isinglass or court plaster
Menhaden Oil	From *Alosa Menhaden.* Habitat, Atlantic Coast. Used in dressing leather
Shark Oil	From the liver of the shark, *Squalis Carcharias,* and other species. It is of a light yellow color, and has an acrid taste. Sp. gr. 0.870 to 0.880
Skate Oil	From the liver of *Raja Batis.* Employed largely in France and Belgium. It is of a bright yellow color. Sp. gr. 0.928
Lipanin	A mixture of 100 parts of olive oil and 6 parts of oleic acid. Used as a substitute for cod liver oil. Dose, one to four fluidrachms (4 to 16 mils)
Class Aves	
Ferratin Ferric Acid Albuminate	A reddish-brown, odorless, and tasteless powder, insoluble in water, but soluble in slightly alkaline solutions. It contains about 7 per cent. of iron, and is given in eight-grain (0.5 Gm.) doses
Ingluvin	From the gizzards of *Gallus Bankiva.* Prepared by a process similar to that employed in preparing pepsin. The dried and powdered gizzards are often used as digestives
Lecithin, $C_{44}H_{20}NPO_9$ Distearin-Glycero Phosphoric-Cholin ester	A phosphated substance, prepared from the yolk of egg, nerve tissue, blood, and bile. A colorless, crystalline compound, soluble in alcohol and ether. Used as a nerve tonic in doses of one to two grains (0.065 to 0.13 Gm.)
Protargol	A silver compound with albumin containing about 8 per cent. of silver. It is a yellow powder, soluble in water; astringent and bactericide like silver nitrate but not caustic. Used in ¼ to 2 per cent. solutions for wounds and gonorrhœa
Vitellin	It exists in the yolk of eggs. Closely resembles fibrin
Class Insecta	
Cobweb	The web of *Tegeneria domestica.* It has been recommended in phthisis and chronic intermittents, but is most useful in controlling hemorrhage by simply applying it to the bleeding surfaces
Blatta Cockroach	The insect *Blatta orientalis,* about one inch long, oblong, flat, of a reddish-black color, odor very disagreeable. It contains fetid oil, extractive, antihydropin, etc. Used as a diuretic
Red Ant	The insect *Formica rufa.* It contains a volatile oil and formic acid
Class Reptilia	
Crotalus	Prepared from the venom of the rattlesnake (*Crotalus horridus*). While the snake is under chloroform the poison contained in the fang is pressed out and mixed with 9 parts of glycerin. Used in epilepsy
Phynin	From the glandular secretion and dried skin of the toad (*Bufo viridis* and *B. cinereus*). Similar in ts effects to digitalin
Class Annelida	
Hirudo Leech (Br. 1914)	From *Hirudo medicinalis* and *Hirudo quinquestriata.* From three of six inches long, smooth, soft, round, tapering at the ends, composed of about one hundred rings; of a blackish-green color. Used for local depletion

Condensed Chart of U. S. P. Animal Substances and Derivatives

Official Name	Part used	English Name	Official Preparation
Acidum Lacticum	. . . .	Lactic Acid	*U. S. Prep.*—Syrupus Calcii Lactophosphatis. *N. F. Prep.*—Elixir Calcii Lactophosphatis, Elixir Glycerophosphatum Compositum, Elixir Pepsini et Rennini Compositum, Emulsum Olei Morrhuæ cum Calcii Lactophosphate
Oleicum	. . . .	Oleic Acid	*U. S. Prep.*—Oleatum Hydrargyri. *N. F. Prep.*—Oleatum Aconitinæ, Oleatum Atropinæ, Oleatum Cocainæ, Oleatum Quininæ, Oleatum Veratrinæ, Petroxolinum Creosoti, Petroxolinum Guaiacolis, Petroxolinum Hydrargyri, Petroxolinum Iodi, Petroxolinum Iodoformi, Petroxolinum Liquidum, Petroxolinum Spissum, Petroxolinum Sulphuratum
Stearicum	. . . .	Stearic Acid	*U. S. Prep.*—Suppositoria Glycerini. *N. F. Prep.*—Linimentum Saponato-Camphoratum
Adeps	Prepared internal fat from the abdomen of the hog	Lard	*U. S. Prep.*—Adeps Benzoinatus, Ceratum Resinæ, Emplastrum Plumbi, Linimentum Terebinthinæ, Unguentum Hydrargyri Nitratis, Unguentum Picis Liquidæ. *N. F. Prep.*—Unguentum Camphoræ, Unguentum Picis Compositum, Unguentum Sulphuris Compositum
Benzoinatus	Prepared from lard and benzoin	Benzoinated Lard	*U. S. Prep.*—Ceratum, Ceratum Cantharidis, Unguentum, Unguentum Belladonnæ, Unguentum Chrysarobini, Unguentum Hydrargyri, Unguentum Iodi, Unguentum Iodoformi, Unguentum Stramonii, Unguentum Sulphuris, Unguentum Zinci Oxidi. *N. F. Prep.*—Ceratum Camphoræ, Mulla Hydrargyri, Chloridi Corrosivi, Mulla Acidi Salicylici, Mulla Zinci, Pasta Zinci Sulphurata, Unguentum Plumbi Iodidi, Unguentum Potassii Iodidi, Unguentum Sulphuris Alkalinum, Unguentum Veratrinæ
Lanæ	Purified fat of the wool of sheep	Wool Fat	*N. F. Prep.*—Ceratum Plumbi Subacetatis, Unguentum Resorcinolis Compositum
Lanæ Hydrosus	Purified fat of the wool of sheep, containing 25 to 30 per cent. of water	Hydrous Wool Fat	*U. S. Prep.*—Unguentum Belladonnæ, Unguentum Hydrargyri Ammoniati, Unguentum Hydrargyri Oxidi Flavi, Unguentum Stramonii. *N. F. Prep.*—Inunctum Mentholis, Inunctum Mentholis Compositum, Petroxolinum Hydrargyri, Unguentum Hydrargyri Oxidi Rubri
Cantharis	Entire beetle	Cantharides	*U. S. Prep.*—Ceratum Cantharidis, Collodium Cantharidatum, Emplastrum Cantharidis, Tinctura Cantharidis
Cera Alba	Yellow wax, bleached	White Wax	*U. S. Prep.*—Ceratum, Unguentum, Unguentum Aquæ Rosæ. *N. F. Prep.*—Ceratum Camphoræ, Ceratum Plumbi Subacetatis, Petroxolinum Spissum, Unguentum Camphoræ
Flava	Purified honeycomb of the bee	Yellow Wax	*U. S. Prep.*—Ceratum Cantharidis, Ceratum Resinæ, Emplastrum Resinæ, Linimentum Terebinthinæ, Unguentum Picis Liquidæ. *N. F. Prep.*—Ceratum Resinæ Compositum, Emplastrum Fuscum Camphoratum, Mulla Creosoti Salicylata, Unguentum Picis Compositum, Unguentum Resorcinolis Compositum
Cetaceum	Concrete fatty substance from sperm whale	Spermaceti	*U. S. Prep.*—Unguentum Aquæ Rosæ
Coccus	Dried insect	Cochineal	*U. S. Prep.*—Tinctura Cardamomi Composita, Liquor Cocci, Syrupus Asari Compositus, Tinctura Kino et Opii Composita
Fel Bovis	Fresh bile of the ox	Oxgall	*U. S. Prep.*—Extractum Fellis Bovis
Gelatinum	Hydrolysis of animal tissues	Gelatin	*U. S. Prep.*—Gelatinum Glycerinatum
Glycerinum	. . . .	Glycerin	*Prep.*—See page 1247
Hypophysis Sicca	Posterior lobe from pituitary body of cattle	Desiccated Hypophysis	*U. S. Prep.*—Liquor Hypophysis

Condensed Chart of U. S. P. Animal Substances and Derivatives—*Continued*

Official Name	Part used	English Name	Official Preparation
Mel	Saccharine secretion from honeycomb	Honey	*U. S. Prep.*—Mel Depuratum
Moschus	Dried secretion	Musk	*U. S. Prep.*—Tinctura Moschi
Oleum Morrhuæ	Fixed oil from fresh livers of the cod	Cod Liver Oil	*U. S. Prep.*—Emulsum Olei Morrhuæ *N. F. Prep.*—Emulsum Olei Morrhuæ cum Calcii Lactophosphate, Emulsum Olei Morrhuæ cum Calcii Phosphate, Emulsum Olei Morrhuæ cum Malto, Emulsum Olei Morrhuæ cum Hypophosphitibus, Emulsum Olei Morrhuæ cum Pruno Virginiana, Emulsum Olei Morrhuæ cum Vitello
Pancreatinum	Enzymes from pancreas	Pancreatin	*N. F. Prep.*—Liquor Pancreatini, Pulvis Pancreatini Compositus
Pepsinum	Ferment from fresh stomach of the hog	Pepsin	*N. F. Prep.*—Elixir Cinchonæ Alkaloidorum Ferri et Pepsini, Elixir Pepsini, Elixir Pepsini, Bismuthi et Strychninæ, Elixir Pepsini et Bismuthi, Elixir Pepsini et Ferri, Elixir Pepsini et Rennini Compositum, Glyceritum Pepsini, Liquor Ferri Peptonati, Liquor Ferri Peptonati et Mangani, Liquor Pepsini, Liquor Pepsini Antisepticus, Liquor Pepsini Aromaticus, Pepsinum Saccharatum, Succus Citri et Pepsini, Vinum Pepsini
Saccharum Lactis	. . . .	Sugar of Milk	*U. S. Prep.*—Ferri Carbonas Saccharatus, Pulvis Ipecacuanhæ et Opii, Trituratio Elaterini. *N. F. Prep.*—Pepsinum Saccharatum
Serum Antidiphthericum	Serum from immunized blood of horse	Antidiphtheric Serum	
Purificatum	Solution of globulins from blood of immunized horse	Purified Antidiphtheric Serum	
Siccum	Dried serum from blood of immunized horse	Dried Antidiphtheric Serum	
Serum Antitetanicum	Serum from blood of immunized horse	Antitetanic Serum	
Purificatum	See above	Purified Antitetanic Serum	
Siccum	See above	Dried Antitetanic Serum	
Sevum Præparatum	Purified internal fat from the abdomen of the sheep	Prepared Suet	*U. S. Prep.*—Unguentum Hydrargyri. *N. F. Prep.*—Ceratum Resinæ Compositum, Sevum Benzoinatum, Unguentum Fuscum
Suprarenalum Siccum	Dried suprarenal glands of animals	Dried Suprarenals	
Thyroideum Siccum	Thyroid glands of animals	Dried Thyroids	
Virus Vaccinicum	Prepared pustules of vaccinia	Vaccine Virus	

Condensed Chart of N. F. Animal Substances and their Products

Acidum Formicum	. . . .	Formic Acid	*N. F. Prep.*—Elixir Formatum, Elixir Formatum Compositum, Spiritus Acidi Formici
Extractum Carnis	Residue from fresh beef broth	Extract of Beef	*N. F. Prep.*—Vinum Carnis, Vinum Carnis et Ferri
Lac Vaccinum	Fresh milk	Cow's Milk	*N. F. Prep.*—Lac Fermentatum
Ovi Albumen Recens	Separated liquid, white portion of eggs	Fresh Egg Albumen	*N. F. Prep.*—Linimentum Opii Compositum, Liquor Ferri Albuminati, Liquor Ferri Peptonati, Liquor Ferri Peptonati et Mangani
Vitellum Recens	Separated Yolk	Fresh Egg Yolk	*N. F. Prep.*—Emulsum Olei Morrhuæ cum Vitello, Glyceritum Vitelli
Ovum Gallinaceum	Whole egg	Fresh Egg	*N. F. Prep.*—Linimentum Terebinthinæ Aceticum
Renninum	Milk-curdling enzyme from glandular layer of stomach of calf	Rennin	*N. F. Prep.*—Elixir Pepsini et Rennini Compositum

CHAPTER LXII

PHARMACEUTICAL TESTING

A KNOWLEDGE of the methods of using tests with the view of identifying or ascertaining the amount of impurities in articles of the materia medica, is now demanded of the pharmacist. The professional chemist can no longer claim the exclusive right to handle the test tube and the burette, for the principles of analysis, so far as they relate to medicinal chemicals, must be understood by the practical pharmacist. It is not within the scope of this work to enter into the minute details of the application of each test, the many excellent works on analysis which have been issued within the last few years fully supplying all needs in this direction.

The introduction of many new tests into the last Pharmacopœia, however, requiring the use of various reagents and test solutions, necessitates a brief review of the methods employed in analysis, with some definitions of common terms.

Synthesis and **Pharmacy** treat of the creation or preparation of compounds by *building them up* from their constituents. Thus, by heating together iodine and sulphur, the compound, sulphur iodide, is made.

Analysis is the opposite operation. It treats of the decomposition of the compound by *separating* its constituents. If sulphur iodide be boiled with water, the iodine will be volatilized and may be collected, while the sulphur remains with the water, and thus the compound is decomposed and its constituents are separated.

The principles of analysis are based upon the application of one chemical substance, of known properties and composition, to another, which results in some change in the color, form, or state of aggregation of one or both substances, and which is intended to lead to the identification of the substance examined, or to the determination of its quantity.

Analytical methods require the use of *reagents*, *test solutions*, or *volumetric solutions*. These may be defined as substances employed in producing the phenomena above described, or the *reactions* upon which the value of the analysis is based. A list of official reagents and test solutions is given on the following pages.

Two kinds of analysis, depending upon the extent of the examination, are in use: 1. Qualitative. 2. Quantitative.

In *qualitative* analysis, the aim is merely the *identity* or the *quality* of the objects sought for, in the substance examined.

In *quantitative* analysis, not only must the substance sought for be identified, but the *quantity* which is present must also be ascertained. Two methods of quantitative analysis are in use, known as Gravimetric and Volumetric.

In *gravimetric* quantitative analysis, as its name indicates, the quantities of the constituents are isolated and *weighed*, either separately or in combination.

In *volumetric* quantitative analysis, the constituents are determined, either wholly or in part, in *volume* or *measure*, by dissolving a given weight of a pure salt or body in a definite volume of water or other liquid, thus forming a *standard* or *normal solution*, and using an accurately measured quantity of such a solution to produce a given effect upon the substance which is being tested. The advantages of the volumetric method consist in the ease and rapidity with which the operations may be effected, because liquids can be measured more rapidly than they can be weighed.

It is obvious that volumetric analysis can be used only where some distinctly visible phenomenon occurs in the liquid, which enables the operator to determine accurately a point when the reaction is completed.

In volumetric analysis, accurately made solutions of definite strength are employed. In the Pharmacopœia these are termed test solutions and volumetric solutions. In general practice the term *normal solution* is used, but, unfortunately, it is applied to several kinds of volumetric solutions, which may be defined as follows:

1. A normal solution is primarily and legitimately one which contains the *molecular weight* of a *univalent* substance, expressed in grammes, dissolved in a sufficient amount of pure water to make exactly *1000 mils* or *one liter*. Thus the molecular weight of sodium hydroxide is 40.01, and hence normal solution of sodium hydroxide contains 40.01 grammes of sodium hydroxide in 1000 mils, or 1 liter, of the solution. When the substance is *bivalent*, the normal solution contains *one-half* of the molecular weight, expressed in grammes, in each liter, as in the normal volumetric solution of sulphuric acid. The molecular weight of sulphuric acid is 98.09, and the normal solution is made by dissolving 49.045 grammes of the acid in sufficient distilled water to make 1000 mils. In the same manner, if the substance is *trivalent*, a normal solution would contain in 1000 mils a weight, in grammes, equivalent to *one-third* of its molecular weight; if *quadrivalent*, *one-fourth* its molecular weight; if *sexivalent*, *one-sixth*, etc. For greater accuracy or convenience, solutions either stronger or weaker than *normal solutions* are frequently used; for example, among the official volumetric solutions will be found, besides the *normal solution*, expressed as $\frac{N}{1}$, *double-normal* $\left(\frac{2N}{1}\right)$, *half-normal* $\left(\frac{N}{2}\right)$, *tenth-normal* $\left(\frac{N}{10}\right)$, *fiftieth-normal* $\left(\frac{N}{50}\right)$, and *hundredth-normal* $\left(\frac{N}{100}\right)$; they being equivalent, respectively, to twice, $\frac{1}{2}$, $\frac{1}{10}$, $\frac{1}{50}$, and $\frac{1}{100}$ the strength of the normal solution. Solutions of this kind are employed in determining the strength and purity of many substances.

2. The term normal solution is, unfortunately, applied also to a liquid of which a given volume (100 mils) corresponds with, or exactly saturates, a given weight (1 Gm.) of only *one* substance. These test liquids are used for technical purposes, and are of use only when employed for the single object for which they were designed. They are intended to indicate the percentage of the pure substance con-

tained in the product examined. They are often employed by manufacturing chemists.

3. Still another kind of normal solution has its strength based on a *special reaction* which takes place when the solution is used for the purpose for which it was intended, the molecular weight or saturating power having no relation to its strength.[1] Normal solution of potassium permanganate is sometimes made in this way, based on the amount of oxygen that it can transfer to the substance under examination.

Proximate analysis is a term applied to the examination of organic substances with a view of isolating or determining the proximate principles present, as the proximate analysis of cinchona bark in proving the presence or quantity of the quinine, cinchonine, kinic acid, etc.

Ultimate analysis is a term applied to the examination of organic substances to determine their ultimate elements, as in an analysis of quinine to prove the number of atoms of carbon, hydrogen, oxygen, and nitrogen in it.

Proximate and ultimate analyses require individual skill and experience and the application of methods which can be properly mastered only by special study and practical experience under competent instructors. They should never be attempted by the tyro.

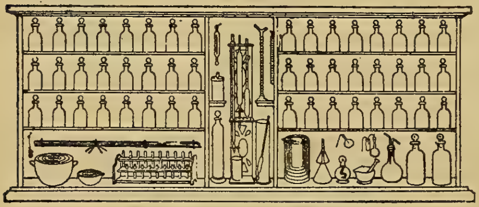
Pharmacopœial testing and volumetric analysis, on the other hand, are directly in the line of the work of the practical pharmacist, and the apparatus required is simple, while the operations to be performed are mostly those which he is called upon to perform daily upon a larger scale.

Practice and experience in analytical work will, if conscientiously followed, prove invaluable in training the pharmacist in those habits of accuracy, neatness, and thoroughness which are absolutely essential to the successful pursuit of his profession.

Apparatus used in Testing

The United States Pharmacopœia very wisely adopted the metric system in all analytical operations requiring definite weights or measures. It is admirably fitted for analytical work, and is used almost universally by chemists throughout the world. Hence the apparatus employed is always based on the metric method.

FIG. 452



Analytical apparatus case

It is well for the pharmacist to set apart a case, especially in the laboratory, in which to keep this apparatus. It should never be used for dispensing purposes. Fig. 452 represents such a case, which may be made as attractive as the taste of the owner dictates.

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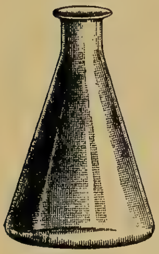
[1] It is greatly to be desired that these last two solutions shall receive some other and appropriate names, so that the term "normal solution" shall have but one signification.

Flasks.—The Erlenmeyer flask, on account of its convenient shape, is almost universally used in assay work (see Fig. 453).

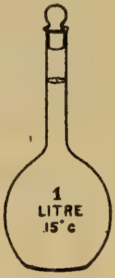
Graduated flasks are needed for making standard and normal solutions. These should be accurately stoppered, and the mark on the neck should extend all the way around, and be in the narrowest part. Liter, half-liter, and quarter-liter flasks are all useful (see Fig. 454).

Fig. 453



Erlenmeyer flask

Fig. 454



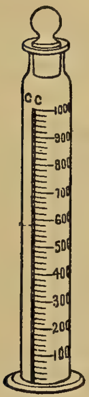
Liter flask

Graduated Jars.—A tall, cylindrical, glass stoppered jar, graduated into one hundred or one thousand equal parts, is of great service in making test solutions in smaller quantities (see Fig. 455).

Graduated Pipette.—The pipette has already been described (see page 223). When graduated it is indispensable for analytical work. Fig. 456 shows a graduated pipette, and Fig. 457 the method of using it.

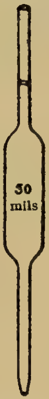
The Burette is indispensable in volumetric testing. It is a graduated glass tube, about one-half inch (12.5 Mm.) in diameter and twenty inches (50.8 Cm.) in length, having its lower end drawn to a narrow orifice, and the other flared to facilitate the pouring in of the test liquid. To the lower extremity is attached a piece of rubber tubing, the other end of the tubing being armed with a short piece of glass tube having a capillary orifice. The graduations on the tube are extended to one hundred parts or more, each part being subdivided into five or ten equal parts (see Fig. 458). The rubber tube is closed with a spring pinchcock, or, as illustrated in Fig. 459, a small piece of glass rod, A, may be inserted in the rubber tube, B, between the burette, C, and the glass tip, D, and the solution made to flow or drop, at the will of the operator, by pinching the rubber surrounding the rod.

Fig. 455



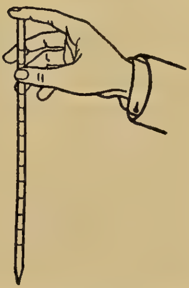
Graduated jar

Fig. 456



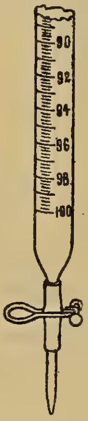
Graduated pipette

Fig. 457



Method of using graduated pipette

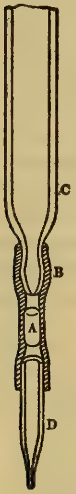
Fig. 458



Burette, enlarged view of end

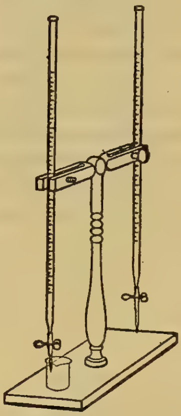
Fig. 460 represents a convenient holder for the burette while in use; the latter may be adjusted to any height to accommodate a large or a small beaker. For volumetric solutions that are decomposed by organic substances, like solution of potassium permanganate, the rubber tube is unsuitable, and *all glass* burettes must be used. These are closed with a small glass stopcock. To facilitate the reading of the divisions on the burette, Erdmann's float is employed (see Fig. 461). This is an elongated glass bulb, of slightly less diameter than the burette, loaded at one end with mercury, and having a little glass hook at the top to facilitate its being lifted out with a bent wire. A line is scratched on the bulb around the middle, and it is floated in the liquid in the burette. The actual height of the liquid is a matter of indifference, because the reading is made by comparing the line on the float with that on the burette. With practice, excellent work may be performed without the use of the float, by adopting the habit of always reading off where the lowest point of the meniscus touches the graduated mark. If the operator is compelled to work in a poor light, the reading of the line may be facilitated by placing a small card, having its lower half blackened, just behind the burette in such a position that the straight line of division between the black and the white portion is very slightly below the surface of the liquid in the burette, or one of the newer devices may be used for assisting the reading,—*i.e.*, a burette having white enamelled sides with dark blue background.

FIG. 459



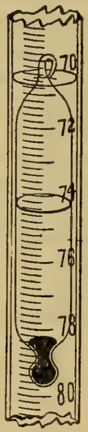
Burette

FIG. 460



Burette holder

FIG. 461



Erdmann's float

FIG. 462

Reagent bottle

The greater part of the apparatus used in such analytical work as the pharmacist is likely to be called upon to perform has been already described in Part I. and elsewhere, and the operations of making solutions, filtration, precipitation, etc., are familiar ones. Glass funnels, beakers, test tubes, stirring rods, porcelain capsules, crucibles, reagent and test solution bottles, etc., will be required.

The amber colored glass reagent bottles made by Whitall Tatum Company, of Philadelphia (see Fig. 462), are well adapted for the purpose of containing the test liquids. The bottles hold about four fluidounces, and the labels are blown in the glass, the surface of the letters being ground off so that they can be read distinctly. Paper labels are not well adapted for test liquids, because they are soon destroyed by the corrosive action of acid or alkaline vapors or the ink marks are bleached out.

The U. S. Bureau of Standards has issued regulations, in Circular No. 9, for the graduation of all glass apparatus for chemical work and it is desirable, when ordering measuring flasks, pipettes, burettes, etc., to specify that they must conform to the requirements of the Bureau.

QUESTIONS ON PHARMACEUTICAL TESTING AND TESTS

Why is a knowledge of chemical testing now demanded by the pharmacist? (See page 1484.)
What is meant by synthesis?
What is meant by analysis?
Upon what are the principles of analysis based?
What are meant by reagents, test solutions, and volumetric solutions?
What two kinds of analysis are in use?
What is meant by qualitative analysis?
What is meant by quantitative analysis?
What two kinds of quantitative analysis are in use, and what is the difference between them?
What is the legitimate and proper meaning of a normal solution?
What are double-normal, half-normal, tenth-normal, fiftieth normal and hundredth-normal volumetric solutions?
In what other ways has the term normal solution been applied?
What is meant by proximate analysis?
What is meant by ultimate analysis?
What system is used by the U. S. Pharmacopæia in analytical operations requiring definite weights or measures?
What is the use of graduated flasks?
What is the use of graduated jars? Of graduated pipettes?
What is a burette, and how is it used?
For test solutions that are decomposed by organic substances, can a rubber tube be used?
What can be used in its place?
What is Erdmann's float? What is its use?
How may pipettes sometimes be used instead of burettes?
What is the best form of reagent bottle?

REAGENTS, TEST SOLUTIONS, AND VOLUMETRIC SOLUTIONS

INTRODUCTORY

Official Substances as Reagents.—Latin official names are not used as titles in the following list, the English names being preferred. Some official substances (chemicals, chemical solutions, etc.) are sufficiently pure to be used as reagents, if they comply with the tests of purity prescribed by the Pharmacopœia. In the case of other official substances, the presence of certain impurities, though immaterial for their use as medicines, renders them unsuitable for employment as reagents. Whenever a greater degree of purity is required than is provided for by the text of the Pharmacopœia it will be specially mentioned in the following list.

Abbreviations and Signs Used:

T.S. = Test Solution.
V.S. = Volumetric Solution.
$\frac{N}{1}$ = Normal (see under "Volumetric Solutions," page 1517).
$\frac{N}{2}$ = Half-normal; $\frac{N}{10}$ = Tenth-normal; $\frac{N}{50}$ = Fiftieth-normal; $\frac{N}{100}$ = Hundredth-normal; $\frac{N}{200}$ = Two-hundredth-normal.
$\frac{2N}{1}$ = Normal (see under "Volumetric Solutions," page 1517).

Keeping of Reagents.—Preserve reagents in bottles made of glass as free as possible from lead or arsenic and closed by well-ground glass stoppers or, in certain cases, rubber stoppers. Ground glass stoppers of bottles containing alkali hydroxides, ammonium sulphide, ammonia water, and other substances of alkaline reaction, which rapidly attack ground glass surfaces, are to be coated with a thin film of petrolatum.

Keep reagents which are easily affected by light, such as hydrogen sulphide T.S., ammonium sulphide T.S., chlorine water, silver nitrate T.S., etc., in bottles made of dark amber-colored glass.

NOTE.—As some of the following test solutions are in certain cases directed to be used in definite quantities, it is important that they always be prepared of the *exact strength prescribed* and measured at the standard temperature of 25° C.

Water, whenever required or mentioned as a solvent in the tests given in the Pharmacopœia, or in the preparation of any reagent, is always understood to be *distilled water.*

REAGENTS AND TEST SOLUTIONS

The reagents are arranged in alphabetical order and the test solutions are usually mentioned in connection with the principal chemical or other substance from which they are prepared.

Acetic Acid.—Use the official acetic acid.

Acetic Anhydride (Acetic Acid Anhydride), $(CH_3.CO)_2O$.—A colorless, mobile, refractive liquid of pungent acetic odor, boiling at about 137° C. Specific gravity about 1.07 at 25° C. When poured into water it sinks at first, but gradually dissolves, forming acetic acid. Dilute 1 mil with about 50 mils of distilled water, add 5 mils of nitric acid, and mix well; the solution gives no reaction upon the addition of silver nitrate T.S. (*hydrochloric acid*). Evaporate 10 mils of acetic anhydride to dryness, completing the drying at 110° C.; the residue weighs not more than 0.5 milligrammes (*non-volatile matter*).

Dissolve 10 mils of acetic anhydride accurately weighed in sufficient distilled water to measure 100 mils and titrate 10 mils of this with normal potassium hydroxide V.S., using phenolphthalein T.S. as indicator; not less than 19.3 mils is required to neutralize 1 Gm. of acetic anhydride. Preserve acetic anhydride in glass-stoppered vials in a cool place.

Acetone.—Use the official acetone.

Albumen Test Solution.—Carefully separate the white of a strictly fresh hen's egg from the yolk, shake it thoroughly with 100 mils of distilled water, and filter. This solution must be freshly made when required.

Alcohol, 94.9 per cent.—Use the official alcohol containing not less than 94.9 per cent., by volume, of C_2H_5OH at 15.6° C. Alcohol of lower strength is prepared as follows:

Alcohol, 90 per cent.—Mix 51 mils of U. S. P. alcohol with 3 mils of distilled water. The specific gravity of the mixture is 0.834 at 15.6° C., corresponding to 90 per cent., by volume, of C_2H_5OH.

Alcohol, 80 per cent.—Mix 45.5 mils of U. S. P. alcohol with 9.5 mils of distilled water. The specific gravity of the mixture is 0.864 at 15.6° C., corresponding to 80 per cent., by volume, of C_2H_5OH.

Alcohol, 70 per cent.—Mix 38.6 mils of U. S. P. alcohol with 15 mils of distilled water. The specific gravity of the mixture is 0.890 at 15.6° C., corresponding to 70 per cent., by volume, of C_2H_5OH.

Alcohol, Dehydrated, C_2H_5OH.—Use the official dehydrated alcohol, containing not less than 99 per cent., by volume, of C_2H_5OH.

Ammonia, Spirit of.—An alcoholic solution of ammonia (NH_3) containing 10 per cent., by weight, of the gas. It responds to the tests for purity given under U. S. P. ammonia water.

Ammonia Test Solution.—Use the official ammonia water.

Ammonium Carbonate Test Solution.—Dissolve 20 Gm. of U. S. P. ammonium carbonate in a mixture of 20 mils of ammonia water and 65 mils of distilled water, and add sufficient distilled water to measure 100 mils.

Ammonium Chloride Test Solution.—Dissolve 10 Gm. of ammonium chloride, NH_4Cl, in sufficient distilled water to measure 100 mils. In addition to the tests prescribed for this salt under the official ammonium chloride the following must be complied with when employed in the test for lead under citric acid, tartaric acid, potassium bitartrate, or potassium and sodium tartrate. Dissolve 3 Gm. of the salt in 10 mils of distilled water acidified with 1 drop of diluted hydrochloric acid in a test tube of colorless glass, having an internal diameter of 2 cm., add 10 mils of hydrogen sulphide T.S., which must be perfectly clear and colorless, and mix well. The liquid must show no discoloration when viewed downward against a white surface.

Ammonium Molybdate Test Solution.—Mix 6.5 Gm. of finely powdered molybdic acid (see page 1504) with 14 mils of distilled water and 14.5 mils of stronger ammonia water to effect solution. Cool and slowly add the solution, in small portions with agitation, to a well cooled mixture of 32 mils of nitric acid and 40 mils of distilled water. Allow the solution to stand for twenty-four hours and then filter through asbestos.

Preserve the test solution in the dark, and, if a sediment should form in it after some days, carefully decant the clear solution. This solution should be tested at frequent intervals. Add 2 mils of sodium phosphate T.S. to 5 mils of the reagent; an abundant yellow precipitate forms either at once or upon slight warming. If only a slight precipitation or yellow opalescence results, the reagent must be rejected. When employed as a reagent, ammonium molybdate T.S. is always added in large excess to the solution being tested, the latter having previously been strongly acidified with nitric acid.

Ammonium Nitrate, NH_4NO_3.—Colorless crystals, soluble in less than their own weight of water, and in about 10 parts of alcohol. This salt when used as a reagent conforms to the tests for purity given under the official ammonium chloride, and, in addition, responds to the following tests: Ten mil portions taken separately of an aqueous solution of the salt (1 in 10), acidulated with a few drops of nitric acid, yield no turbidity on the addition of a few drops of silver nitrate T.S. (*chloride*) or a few drops of barium nitrate T.S. (*sulphate*). Dissolve 1 Gm. of ammonium nitrate in 10 mils of distilled water, add a few drops of potassium iodide T.S., 1 mil of acetic acid and a few drops of starch T.S.; no blue color is produced (*nitrite*).

Ammonium Oxalate Test Solution.—Dissolve 4 Gm. of crystallized ammonium oxalate, $(NH_4)_2C_2O_4 + H_2O$, in sufficient distilled water to measure 100 mils, or dissolve 3.548 Gm. of purified oxalic acid (see page 1506) in 90 mils of distilled water, add 13 mils of ammonia water, boil to expel any excess of ammonia, and dilute with distilled water to make 100 mils.

Evaporate 50 mils of the test solution and ignite the residue, or ignite 2 Gm. of the salt; it leaves not more than 0.02 Gm. of residue (*fixed impurities*). The precipitate produced by the addition of silver nitrate T.S. or by barium chloride T.S., when added to 25 mils of the test solution, dissolves without residue upon the addition of nitric acid (*chloride and sulphate*).

Ammonium Polysulphide Test Solution.—A yellow liquid, made by dissolving a small quantity of the official precipitated sulphur in colorless ammonium sulphide T.S.

Ammonium Sulphate, $(NH_4)_2SO_4$.—This salt must respond to the following tests for purity: Two Gm. yields not more than 0.002 Gm. of residue on ignition (*fixed impurities*). Five mils of an aqueous solution of the salt (1 in 10) does not respond to the Test for heavy metals (see Test No. 3). Five mils of a similar solution shows no turbidity upon the addition of nitric acid and silver nitrate T.S. (*chloride*). Another 5 mils of the solution (1 in 10) is not colored red upon the addition of 1 mil of hydrochloric acid and 1 drop of ferric chloride T.S. (*sulphocyanate*). This salt may be prepared by cautiously neutralizing ammonia water with sulphuric acid, which has been previously diluted with about two volumes of distilled water, evaporating and crystallizing. During the evaporation, the solution should be tested with litmus paper, from time to time adding more ammonia, if necessary, to keep the liquid alkaline.

Ammonium Sulphide Test Solution.—Saturate 3 parts of the official ammonia water with hydrogen sulphide, and add to the solution (which now contains ammonium hydrogen sulphide, NH_4HS) 2 parts of ammonia water, which converts the greater portion of the ammonium hydrogen sulphide into ammonium sulphide, $(NH_4)_2S$. Ten mils of the clear ammonium sulphide T.S., when evaporated to dryness and then gently ignited, leaves a residue weighing not more than 0.005 Gm. (*non-volatile matter*). It is not rendered turbid either by magnesium sulphate T.S. (*free ammonia*), or by calcium chloride T.S. (*ammonium carbonate*). Protect it from air and light by keeping it in small, dark, amber-colored bottles, in a cool, dark place. As soon as a notable deposit of sulphur has made its appearance in the solution reject it.

Ammonium Vanadate (Ammonium Metavanadate), NH_4VO_3.—A white crystalline powder, soluble in about 100 parts of cold water and readily soluble in boiling water, forming a yellow liquid. This color is due to partial decomposition through loss of ammonia. When heated the salt assumes a yellow color which changes to brown, then reddish-brown, as the temperature rises.

Amyl Alcohol, $C_5H_{11}OH$.—A colorless, oily liquid having a penetrating characteristic odor, boiling between 128° and 132° C.; soluble in 40 parts of water at 25° C.; miscible with alcohol, ether, chloroform, carbon disulphide, petroleum benzin, benzene, or fixed or volatile oils. Ten mils of amyl alcohol, when evaporated to dryness on a water bath, yields not more than 0.0005 Gm. of residue.

Aniline (Phenylamine), $C_6H_5NH_2$.—When freshly distilled, aniline is a colorless, strongly refractive, oily liquid, having a peculiar, aromatic odor and a pungent, burning taste. Upon exposure to the light and air, it rapidly assumes a reddish-brown color. Specific gravity, about 1.02 at 25° C. Aniline distils completely between 182° and 184° C. It is soluble in alcohol, ether, or the fixed or volatile oils. With acids, it forms soluble crystalline salts. When added to an aqueous solution of calcium or sodium hypochlorite, a blue or purple color is produced. Preserve it in amber-colored bottles.

Aniline Sulphate, $(C_6H_5NH_2)_2H_2SO_4$.—Add gradually 10 Gm. of aniline, $C_6H_5NH_2$, to about 7 Gm. of sulphuric acid, stirring constantly. Dissolve the resulting solid mass in sufficient boiling diluted alcohol and set it aside for crystallization. Collect the crystals upon a filter, and, after draining them, recrystallize the salt from diluted alcohol. Collect the crystals on a filter and finally dry them in a desiccator. Aniline sulphate forms white crystals very soluble in water, less soluble in diluted alcohol, and slightly soluble in alcohol.

Aniline Sulphate Test Solution.—Dissolve 5 Gm. of aniline sulphate in 40 mils of distilled water, add 51 mils of the official diluted alcohol, and sufficient distilled water to make 100 mils.

Arsenic Acid (Ortho-arsenic Acid), $H_3AsO_4 + \frac{1}{2}H_2O$.—In white crystals or as a crystalline mass, very hygroscopic, readily soluble in water and alcohol. It fuses at about 100° C., becoming anhydrous at 110° C. At higher temperatures, it is converted into the pyro-acid and, finally, at 200° C., into the meta-acid. The addition of silver nitrate T.S. to an aqueous solution of arsenic acid, followed by the gradual addition of ammonia water, drop by drop, produces a red-brown precipitate which is readily soluble in a slight excess of ammonia water. With magnesia mixture T.S., arsenic acid solutions give a white crystalline precipitate. One mil of an aqueous solution of the salt (1 in 10), after neutralizing with sodium carbonate, does not decolorize 1 drop of iodine T.S. (*arsenous oxide*). To 10 mils of a solution of ferrous sulphate (1 to 10) add 0.5 mil of an aqueous solution of arsenic acid (1 in 10) and float this over concentrated sulphuric acid contained in a test tube; no brown ring is formed at the zone of contact (*nitric acid*).

Arsenic Acid Test Solution, Concentrated.—For use in the assay for eucalyptol prepare this solution by dissolving 85 Gm. of crystalline arsenic acid (see above) in sufficient distilled water to make the product weigh 100 Gm. This solution has a specific gravity of about 2.173 at 25° C. The test solution may also be prepared by adding 56 Gm. of arsenic trioxide, in small portions, to 60 mils of nitric acid contained in a porcelain evaporating dish, stirring continuously and warming gently to assist the evolution of nitrous vapors. When all of the arsenic trioxide has been added, evaporate to a syrupy consistence, add about 25 mils of distilled water and again evaporate, and then repeat this operation once more. Finally dilute with distilled water until the solution weighs 100 Gm. This solution must comply with the tests for identity and purity given under *Arsenic Acid* (see preceding article). If the tests indicate the presence of arsenous oxide, more nitric acid must be added and the evaporation repeated. If nitric acid is present, the solution should be repeatedly diluted and evaporated.

Arsenic Trioxide (Arsenous Oxide), As_2O_3.—For use in the *Arsenic Test* use arsenic trioxide which complies with the official description and tests.

Asbestos.—The anhydrous, silky, well-matted variety (not serpentine), commercially known as "Asbestos Wool," which when moistened readily wads when rolled between the fingers. For use as a filtering medium for the "Gooch" crucible, remove the soluble matter by boiling it for one hour with diluted hydrochloric acid, and washing it with boiling water, by decantation, until free from acid. Finally transfer it to a wide-mouthed bottle containing distilled water. When desired for use, shake the mixture and pour it into a Gooch crucible which is attached to a suction pump, distributing the asbestos uniformly over the bottom in a layer sufficiently thick to retain a precipitate.

Azolitmin.—See under *Indicators.*

Azolitmin Test Solution.—See under *Indicators.*

Azur II (Azur Blue II, Methylene-Azur II).—A mixture of equal parts of the chlorides of methylene blue (tetramethylthionine) and methylene-azur (methylene blue sulphonate). A dark green powder, entirely soluble in water with a deep blue color, less soluble in alcohol and slightly soluble in chloroform; insoluble in ether. The addition of tannic acid T.S. to an aqueous solution of azur II (1 in 1000) produces a blue precipitate. The addition of a few drops of hydrochloric acid to a mixture of 5 mils of an aqueous solution of this dye (1 in 1000) and 0.5 Gm. of zinc dust causes decolorization. When the decolorized mixture is filtered, and solution of hydrogen dioxide is added, the deep blue color is restored (reduction to leuco base and reoxidation). The addition of either hydrochloric acid or ammonia water to an aqueous solution of azur II (1 in 1000) produces no change. The addition of sodium hydroxide T.S. to an aqueous solution of azur II (1 in 1000) produces a violet coloration; upon heating the solution a violet precipitate is formed. The addition of potassium iodide T.S. to an aqueous solution of the dye (1 in 1000) produces a violet precipitate; the addition of potassium dichromate T.S. produces a red violet precipitate. Azur II dissolves in concentrated sulphuric acid with a bright green color [distinction from *methylene violet* (dimethylthionolin)]; upon cautiously diluting with distilled water the solution assumes a blue color, remaining clear. Acidulate an aqueous solution of azur II (1 in 1000) with a few drops of hydrochloric acid, then shake it with ether, remove the ethereal layer, and shake it with a diluted solution of sodium hydroxide T.S.; the latter remains uncolored (distinction from *azur II-eosin*).

Azur II-Eosin.—A mixture of methylene blue eosin (methylene blue eosinate) and methylene-azur-eosin (methylene blue sulphone-eosinate). A dark green powder only very slightly soluble in water, more readily soluble in alcohol or glycerin. A warm saturated aqueous solution of azur II-eosin (about 1 in

2000) possesses a blue color with intense shading into violet. Highly dilute solutions possess a slight, greenish opalescence. Its solutions in alcohol or glycerin possess the same color with a strong yellowish-green fluorescence. A saturated aqueous solution of azur II-eosin is precipitated upon the addition of tannic acid T.S. The addition of zinc dust and ammonia water to an aqueous solution of this dye causes decolorization. When filtered, the colorless filtrate, upon standing in the air, quickly assumes a blue color (reduction to a leuco base and reoxidation to original color). A hot, saturated and filtered, aqueous solution of azur II-eosin assumes a pale blue color upon the addition of hydrochloric acid, and the dye separates in blue floccules. If this acid solution is agitated with ether and the ethereal layer removed and shaken with diluted sodium hydroxide T.S., the latter assumes an eosin color (distinction from *azur II*). The addition of sodium hydroxide T.S. to a saturated aqueous solution of azur II-eosin intensifies its violet color. Azur II-eosin dissolves in concentrated sulphuric acid with a deep green color which, upon dilution with water, changes to a blue, a portion of the dye (eosin) separating in floccules (distinction from *azur II*).

Barium Chloride, $BaCl_2 + H_2O$.—Transparent crystals, easily soluble in water, almost insoluble in alcohol or concentrated hydrochloric acid. An aqueous solution of the salt (1 in 20) is neutral and does not respond to the Test for heavy metals (see Test No. 3). Dissolve 2 Gm. of barium chloride in 100 mils of distilled water, add 2 mils of hydrochloric acid, heat to boiling, then add a slight excess (about 10 mils) of diluted sulphuric acid, set it aside for twelve hours, and filter. The clear filtrate, on evaporating and igniting, yields a residue weighing not more than 0.002 Gm. (*other fixed bases*). Shake 1 Gm. of the finely powdered salt with 20 mils of dehydrated alcohol during five minutes and filter; the filtrate on evaporation and ignition yields not more than 0.002 Gm. of residue (*strontium and calcium*).

Barium Chloride Test Solution.—Dissolve 10 Gm. of barium chloride in sufficient distilled water to measure 100 mils.

Barium Hydroxide, $Ba(OH)_2 + 8H_2O$.—White crystals, soluble in about 20 parts of cold water and 3 parts of boiling water. The salt readily absorbs carbon dioxide from the air, forming an insoluble carbonate, hence aqueous solutions are more or less turbid. A solution of 1 Gm. of barium hydroxide in 50 mils of distilled water and 5 mils of nitric acid shows no opalescence upon the addition of silver nitrate T.S. (*chloride*). Dissolve 2 Gm. of the salt in 100 mils of distilled water, add 5 mils of hydrochloric acid, heat to boiling, then add a slight excess of diluted sulphuric acid, set it aside for twelve hours, and filter; the clear filtrate, on evaporating and igniting, yields a residue weighing not over 0.003 Gm. (*other fixed bases*). The solution of 1 Gm. of barium hydroxide in 20 mils of distilled water rendered acid with hydrochloric acid, does not respond to the Test for heavy metals (see Test No. 3). One Gm. of barium hydroxide dissolved in 100 mils of distilled water requires not less than 6.3 mils of normal hydrochloric acid V.S. for neutralization, using methyl orange T.S. or methyl red T.S. as indicator. Each mil of normal hydrochloric acid V.S. corresponds to 0.157755 Gm. of barium hydroxide [$Ba(OH)_2 + 8H_2O$].

Barium Hydroxide Test Solution.—A saturated solution of barium hydroxide, (see above) in recently boiled distilled water. This solution rapidly absorbs carbon dioxide from the air. Prepare a fresh solution when required for use.

Barium Nitrate, $Ba(NO_3)_2$.—Colorless crystals, soluble in 20 parts of cold water and 2.8 parts of boiling water; its solution is neutral to litmus. The addition of silver nitrate T.S. to an aqueous solution of the salt (1 in 20) produces no change (*chloride*). Barium nitrate meets the requirements of the tests for "other fixed bases" and "heavy metals" given under *Barium Chloride* (see above).

Barium Nitrate Test Solution.—Dissolve 5 Gm. of barium nitrate in sufficient distilled water to measure 100 mils.

Beef Extract (Meat Extract).—Use extract of beef complying with the tests of the U. S. Department of Agriculture, preferably the kind known as "Liebig's."

Benzene (Benzol or Benzole).—Benzene, C_6H_6, is a colorless, transparent, inflammable liquid of a peculiar, aromatic odor; specific gravity about 0.876 at 25° C.; congealing at about 5.2° C.; boiling between 79° and 80.4° C. It is insoluble in water, but soluble in 4 parts of alcohol and also in ether. When equal volumes of benzene and concentrated sulphuric acid are shaken together, the latter is not colored. Shake 2 mils of benzene with 0.5 mil of sulphuric acid and 1 drop of fuming nitric acid; no green or blue tint is produced (*thiophene*).

Benzidine (Paradiaminodiphenyl), $(C_6H_4)_2(NH_2)_2$.—A white or slightly reddish crystalline powder. It is very slowly soluble in cold water, more readily in boiling water; soluble in alcohol and in ether. It melts at about 128° C. On adding a few drops of barium chloride T.S. to a solution of 1 Gm. of benzidine in 50 mils of distilled water acidulated with 5 mils of hydrochloric acid, no turbidity is produced (*sulphate*). One Gm. of benzidine upon ignition leaves no weighable residue.

Benzin (Petroleum Benzin).—Use the official purified petroleum benzin.

Beta-iminazolyl-ethylamine Hydrochloride.—Used in standardizing solution of the pituitary body (see *Liquor Hypophysis*).

Blood Serum.—The serum filtered from the clotted blood of the horse or ox.

Bromine, Br.—Preserve it in a glass-stoppered bottle in a cool place, the bottle being enclosed in a larger vessel with the space between filled with some substance (as calcium hydroxide) capable of absorbing and combining with any vapors which might be given off. A heavy, dark brownish-red, mobile liquid, evolving, even at ordinary temperatures, reddish fumes, highly irritating to the eyes and lungs, and having a peculiar, suffocating odor, resembling that of chlorine. Specific gravity about 3.1 at 25° C. Boiling point, about 63° C. Bromine is soluble in 90 times its volume of water at 25° C.; freely soluble in alcohol or ether (with gradual decomposition of these solvents); also soluble in chloroform, carbon disulphide, or carbon tetrachloride with a deep reddish-yellow color. On exposure to air or to heat, it is volatilized. Bromine destroys the color of solutions of litmus or indigo, and imparts a yellow color to starch T.S. Add 5 mils of bromine to an excess of potassium hydroxide T.S.; it combines to form a permanently clear liquid, without the separation of oily drops (*organic bromine compounds*). Shake 10 mils of a saturated aqueous solution of bromine with a slight excess of reduced iron until it becomes nearly colorless; the filtered liquid, on the addition of 5 drops of ferric chloride T.S. and of 5 drops of starch T.S., does not assume a blue color (*iodine*).

Bromine Test Solution (Bromine Water).—A saturated aqueous solution of bromine prepared by adding 3 mils of bromine to 100 mils of cold distilled water contained in a glass-stoppered bottle, the stopper of which should be lubricated with petrolatum. Keep this reagent in a cool place, protected from the light, and shake it well, allowing the excess of bromine to settle, before using.

Cadmium and Potassium Iodide.—A mixture of equal weights of cadmium iodide and the official potassium iodide may be employed. A white powder readily soluble in water or alcohol. Upon keeping, it acquires a yellowish color. Dissolve 1 Gm. of the powder in 20 mils of distilled water, add 5 mils of potassium hydroxide T.S., and filter the solution; the filtrate yields no precipitate with hydrogen sulphide T.S., either before or after acidulating with hydrochloric acid (*foreign metals*). An aqueous solution of the salt (1 in 20) prepared with distilled water, which has been previously boiled and cooled, gives no blue color upon the addition of starch T.S. (*free iodine*).

Cadmium Chloride, $CdCl_2 + 2H_2O$.—Small white crystals which effloresce in dry air and are soluble in about 0.7 part of cold or hot water. An aqueous solution of the salt gives a yellow precipitate with ammonium sulphide T.S. which is insoluble in an excess of the reagent.

Cadmium Chloride Test Solution.—Dissolve 10 parts of cadmium chloride in sufficient distilled water to make 100 parts.

Cadmium Iodide, CdI_2.—Colorless to yellowish, glossy scales, soluble in 1.1 parts of cold water and in 0.75 part of boiling water, readily soluble in alcohol. Solutions of this salt, upon the addition of alkali hydroxides, yield a white precipitate of cadmium hydroxide insoluble in an excess of the reagent; the precipitate produced by the addition of ammonia water is soluble in an excess of the reagent. Hydrogen sulphide T.S. or ammonium sulphide T.S. added to an aqueous solution of the salt yields yellow cadmium sulphide which is insoluble in an excess of the latter reagent. Add 10 mils of potassium hydroxide T.S. to a solution of 1 Gm. of cadmium iodide in 20 mils of distilled water, and filter; the filtrate yields no precipitate with hydrogen sulphide T.S. either before or after acidulating with hydrochloric acid (*foreign metals*).

Calcium Chloride Test Solution.—Dissolve 10 Gm. of the official calcium chloride in sufficient distilled water to measure 100 mils.

Calcium Hydroxide Test Solution (Lime Water), a nearly saturated, aqueous solution of calcium hydroxide, $Ca(OH)_2$.—Use the official lime water.

Calcium Sulphate Test Solution.—Introduce pulverized transparent crystals of native gypsum (selenite), ($CaSO_4 + 2H_2O$), into a bottle nearly filled with distilled water, agitate it at intervals for twelve hours, and decant the clear, saturated solution when required. One part of gypsum requires about 400 parts of water for solution at 25° C. The test solution may also be made by shaking together 1 Gm. of calcium carbonate and 200 mils of distilled water, containing 5 mils of diluted sulphuric acid. When the acid is completely neutralized filter the mixture.

Canada Turpentine.—A liquid oleoresin obtained from *Abies balsamea* (Linné) Miller (Fam. *Coniferæ*). Viscid, pale yellowish or greenish-yellow, transparent; odor agreeable, taste terebinthinate, bitter, and slightly acrid; it is completely soluble in ether, chloroform, or benzene. When exposed to the air, Canada turpentine gradually dries and forms a transparent varnish; it solidifies on being mixed with 20 per cent. of its weight of magnesium oxide previously moistened with water.

Carbon Disulphide, CS_2 (Carbon Bisulphide).—Preserve in partially filled, well-stoppered bottles, or in tin cans, in a cool place, remote from flame or fire. A clear, colorless, highly refractive liquid, very volatile, having a strong, characteristic but not fetid odor, and a sharp, aromatic taste. Specific gravity between 1.256 and 1.257 at 25° C. Soluble in about 530 parts of water at 25° C.; very soluble in alcohol, ether, chloroform, or fixed or volatile oils. Carbon disulphide vaporizes rapidly at the ordinary temperature, is highly inflammable, boils between 46° and 49° C., and, when ignited, burns with a bluish-white flame, producing carbon dioxide and sulphur dioxide. It does not affect the color of blue litmus paper moistened with water (*sulphur dioxide*). Twenty mils when allowed to evaporate spontaneously in a glass dish and finally on a water bath leaves not more than 0.001 Gm. of residue (*dissolved sulphur*). No discoloration is produced in 10 mils of lead acetate T.S. after agitating with 25 mils of carbon disulphide, when viewed from above in a test tube of about 2 cm. in diameter (*hydrogen sulphide*).

Carbon Tetrachloride, CCl_4.—A colorless, heavy liquid, of characteristic odor; non-inflammable; specific gravity about 1.58 at 25° C.; boiling point between 76° and 77° C. It is immiscible with water, but miscible with dehydrated alcohol, ether, or fixed or volatile oils. Shake 10 mils with 20 mils of distilled water and allow the liquids to separate completely; the water remains neutral to litmus, and becomes not more than slightly opalescent on the addition of silver nitrate T.S. (*chloride*), and is not colored by potassium iodide T.S. (*chlorine*). Twenty-five mils when evaporated on a water bath leaves not more than 0.0005 Gm. of residue (*non-volatile matter*). To 10 mils of a solution of potassium hydroxide in dehydrated alcohol (1 in 10), add 10 mils of carbon tetrachloride; after standing for one hour, acidify with acetic acid and add 1 mil of copper sulphate T. S.; no yellow precipitate appears within two hours (*carbon disulphide*).

Carmine.—A lake color obtained from cochineal by the precipitation of its aqueous infusion with inorganic salts and albumen. Bright red, light and friable lumps, insoluble in cold water and acids, partially soluble in hot water, soluble in ammonia water with a dark red color. When dried at 100° C., 1 Gm. of carmine loses not more than 0.25 Gm. in weight; the residue ignited cautiously in a porcelain crucible, leaves not more than 0.12 Gm. of ash. During the ignition no odor like that of phenol or bromine is perceptible (*aniline colors*). Excepting for a few floccules, 0.15 Gm. of carmine dissolves completely in a mixture of 5 mils of ammonia water and 20 mils of distilled water.

Chlorine Test Solution (Chlorine Water).—Place 10 Gm. of official manganese dioxide in a flask connected by a suitable tube with a small wash bottle containing 50 mils of water, and connect this with a bottle having a capacity of 1000 mils and containing 400 mils of distilled water which has previously been boiled and allowed to cool. Add to the dioxide in the generating flask 25 mils of hydrochloric acid, previously diluted with 25 mils of water, and apply a gentle heat by means of a sand bath. Conduct the generated chlorine through the water contained in the wash bottle into the bottle containing the distilled water, which should be loosely stopped with cotton and kept, during the operation, at a temperature of about 10° C. When the air has been entirely displaced by the gas, disconnect the bottle from the apparatus, and, having inserted the stopper, shake the bottle, loosening the stopper from time to time, until the gas ceases to be absorbed. If necessary, reconnect the bottle with the apparatus, and continue passing the gas and agitating, until the distilled water is saturated. Finally, pour the chlorine water into small, dark amber-colored glass-stoppered bottles, which should be completely filled, and preserve them in a dark and cool place.

Chlorine Water, even when kept from light and air, is apt to deteriorate. When it is required of full strength, it should be freshly prepared.

Chloroform, $CHCl_3$.—Use official chloroform.

Cobaltous Chloride, $CoCl_2 + 6H_2O$.—Rose-colored, monoclinic crystals, non-hygroscopic, soluble in water or alcohol. Dissolve 2 Gm. of the salt in about 100 mils of distilled water, completely precipitate the cobalt by the addition of an excess of ammonia water followed by ammonium sulphide T.S., and filter; the filtrate, after evaporation and ignition, leaves not more than 0.008 Gm. of residue (*alkali salts*). Add 3 Gm. of sodium cyanide to a solution of 1 Gm. of cobaltous chloride, in about 20 mils of distilled water, boil until the solution acquires a yellow color and filter it; on the addition of about 1 mil of bromine followed by sufficient potassium hydroxide T.S. to render the solution strongly alkaline no brown color develops (*nickel*). No coloration is produced in a solution of 2 Gm. of the salt in 100 mils of distilled water, to which 2 mils of nitric acid has been added, upon the addition of hydrogen sulphide T.S. (*lead and copper*).

Cobaltous Chloride Test Solution.—Dissolve 2 Gm. of cobaltous chloride with the aid of 1 mil of hydrochloric acid in sufficient distilled water to measure 100 mils.

Cochineal Test Solution.—See under *Indicators.*

Congo Red.—See under *Indicators.*

Congo Red Test Solution.—See under *Indicators.*

Copper, Metallic, Cu.—In the form of wire, foil, or turnings.

Cupric Acetate, $Cu(C_2H_3O_2)_2 + H_2O$.—Bluish-green crystals, having an acetous odor, soluble in water or alcohol. An aqueous solution of the salt (1 in 20), mixed with a few drops of hydrochloric acid, is not rendered more than slightly turbid at once, upon the addition of a few drops of barium chloride T.S. (*sulphate*). In other respects it meets the tests for purity directed under the official *Cupri Sulphas.*

Cupric Acetate Test Solution.—Dissolve 1 part of cupric acetate in sufficient distilled water to make 1000 parts. Should the solution become cloudy, add acetic acid, drop by drop, until it becomes clear.

Cupric Ammonium Sulphate Test Solution.—A solution of cupri-tetrammonium sulphate, $Cu(NH_3)_4SO_4 + H_2O$. To copper sulphate T.S. add ammonia water, drop by drop, until the precipitate at first formed is nearly, but not completely redissolved, then filter. This solution should be freshly made when required.

Cupric Sulphate Test Solution.—Dissolve 10 Gm. of the official copper sulphate in sufficient distilled water to measure 100 mils.

Cupric Tartrate Test Solution.—See *Volumetric Solutions.*

Curare.—Curare is an impure vegetable extract prepared by the Indians of South America and used by them as an arrow poison. Its composition is not entirely known, and different specimens of curare vary, depending upon the special variety of plant used in its manufacture. The most important source of curare is the bark of several varieties of *Strychnos*, the species most commonly employed being *S. Castelnœi*, Wedd., *S. Toxifera, or S. Crevauxii.* In addition to the extract of these barks other substances are added to impart consistence, to mislead, or perhaps from superstitious considerations. Commercial curare is a brownish or black, shining resinoid mass, possessing a very bitter taste. About 75 per cent. is soluble in cold water and it is almost completely soluble in diluted alcohol.

Dimethylaminoazobenzene (Butter Yellow), $C_6H_5N : N.C_6H_4N(CH_3)_2$.—It forms yellow plates melting between 115° and 117° C. It is insoluble in water, soluble in alcohol; soluble in hydrochloric acid with a red color from which solution sodium hydroxide T.S. in excess precipitates the orange-yellow base. The solution of this dye in sulphuric acid is yellow and changes to red on dilution with water.

Diphenylamine $(C_6H_5)_2NH$.—In the form of grayish-white or colorless crystals of a peculiar, aromatic odor, melting between 53° and 54° C.; slightly soluble in water, more soluble in acids. It is used either in the dry state, or in solution in sulphuric acid, as a test for nitric acid (in sulphuric acid, water, etc.), or for chlorine (in hydrochloric acid). To test a solution for the presence of nitric acid, a small portion of it is carefully poured down the side of a test tube, slightly inclined and containing a few mils of diphenylamine T.S. so as to form a layer over the latter. The presence of nitic acid is shown by a deep blue color at the zone of contact. A similar reaction is also produced by the presence of hypochlorites, chlorates, chromium trioxide, ferric salts, and similar oxidizing agents.

Diphenylamine Test Solution.—Dissolve 0.5 Gm. of diphenylamine in 100 mils of concentrated sulphuric acid (see page 1515) diluted with 20 mils of distilled water. The solution should be colorless.

Eosin A (Yellowish Eosin), $O[C_6H(Br_2O)_2Na]C.C_6H_4COONa$.—The sodium salt of tetra-brom-fluorescein. Fine red crystals of bluish, glossy luster, or a brownish-red powder; readily soluble in water, less soluble in alcohol and insoluble in ether. A concentrated aqueous solution of eosin A has a deep brownish-red color while a dilute solution (1 in 500) is yellowish-red with a greenish fluorescence. The alcoholic solutions show a yellowish-green fluorescence. The addition of tannic acid T.S. to an aqueous solution of eosin A (1 in 500), produces no change. When about 0.5 Gm. of zinc dust, followed by 5 mils of ammonia water, is added to 5 mils of an aqueous solution of eosin A (1 in 500) and the mixture agitated, rapid decolorization takes place. When this mixture is filtered, the addition of solution of hydrogen dioxide to the filtrate restores the pink color of the solution. The addition of hydrochloric acid to an aqueous solution (1 in 500) causes an orange precipitate which, upon agitating with ether, yields a yellow solution. This solution is decolorized upon agitating it with a dilute solution of an alkali. The addition of sodium hydroxide T.S. intensifies the color of an aqueous solution of eosin A (1 in 500). Eosin A dissolves in concentrated sulphuric acid (see page 1515) with a yellow color and, when this solution is cautiously diluted with distilled water, a yellowish-red precipitate is produced.

Ether.—Use official ether. It should be neutral to moistened litmus paper.

Ether, Dehydrated, $(C_2H_5)_2O$.—Specific gravity not greater than 0.7115 at 25° C.; it distils between 34° and 36° C. Add a very small quantity of powdered rosaniline acetate (see page 1510), dried at 100° C., to 10 mils of dehydrated ether, contained in a dry glass cylinder, stopper and shake it. No coloration results (*water or alcohol*). Add some dry tannic acid to 10 mils of dehydrated ether, contained in a dry glass cylinder, stopper and shake it; the tannin does not agglutinate or form a syrupy deposit (*water or alcohol*). Twenty mils of dehydrated ether, when permitted to evaporate spontaneously, leaves no perceptible residue, and upon rinsing the vessel with distilled water, the latter does not distinctly affect litmus paper. If the ether shows the presence of traces of moisture it should be shaken with pieces of anhydrous calcium chloride.

Ethyl Acetate (Acetic Ether), $CH_3.COOC_2H_5$.—A transparent, colorless liquid, of fragrant, acetous odor; inflammable; soluble in about 10 parts of water at 25° C.; miscible in all proportions with alcohol, ether, or volatile oils. Specific gravity: 0.893 to 0.898 at 25° C.; boiling point from 72° to 77° C. On evaporating 10 mils of ethyl acetate on a water bath no weighable residue remains (*non-volatile matter*). Ethyl acetate does not immediately redden blue litmus paper. Evaporate a portion of ethyl acetate spontaneously from clean, odorless blotting paper; the final odor after that of the ester ceases to be noticeable, is not that of foreign esters (*butylic or amylic ester*). Agitate 25 mils of ethyl acetate with 25 mils of a saturated aqueous solution of calcium chloride and permit it to stand for complete separation, the volume of the latter does not increase more than 0.5 mil (*alcohol or water*). Mix 20 mils of ethyl acetate with a solution of 20 Gm. of sodium hydroxide in 50 mils of distilled water, allow the mixture to stand, agitating occasionally, or heat it gently under a reflux condenser, until a homogeneous liquid results, and then distil about 25 mils. This distillate complies with the test for absence of methyl alcohol under *Alcohol*. When 5 mils of ethyl acetate is poured over 5 mils of sulphuric acid, no coloration is produced at the zone of contact of the two layers (*amyl alcohol or other carbonizable impurities*).

Ferric Ammonium Sulphate, $FeNH_4(SO_4)_2 + 12H_2O$.—Pale violet, octahedral crystals, without odor, and having an acid, styptic taste; efflorescent on exposure to the air. Soluble in 2.7 parts of water at 25° C. and in 0.8 part of boiling water; insoluble in alcohol. The addition of 0.5 mil of nitric acid to 10 mils of a solution of the salt (1 in 20), followed by a few drops of silver nitrate T.S., produces no turbidity (*chloride*). The addition of a few drops of a freshly prepared solution of potassium ferricyanide T.S. to a solution of the salt (1 in 20) does not produce a blue or green color (ferrous salt).

Ferric Ammonium Sulphate Test Solution.—Dissolve 10 Gm. of ferric ammonium sulphate in sufficient distilled water to measure 100 mils.

Ferric Chloride Test Solution.—Dissolve 10 Gm. of the official ferric chloride in sufficient distilled water to measure 100 mils.

Ferrous Sulphate Test Solution.—Dissolve a clear crystal of the official ferrous sulphate in about 10 parts of distilled water which has been previously boiled to expel air. This solution is to be freshly prepared immediately before use.

Ferrous Sulphate (Acid) Test Solution.—Dissolve 7.5 Gm. of clear crystals of U. S. P. ferrous sulphate in 90 mils of distilled water which has been previously boiled to expel air, and then add sufficient official sulphuric acid to measure 100 mils. This solution is to be freshly prepared immediately before use.

Ferrous Sulphide, FeS.—A heavy solid, in the form of black or brownish-black irregular masses, or cast into sticks, soluble in diluted sulphuric or diluted hydrochloric acid, with copious evolution of hydrogen sulphide.

Filter Paper Quantitative.—For the Mercuric Bromide Test Paper of the Arsenic Test use Schleicher and Schüll's No. 589 (Blue Ribbon), or Swedish O. filter paper or other makes of like surface, quality and ash (see *Arsenic Test*).

Fluorescein (Resorcinolphthalein).—A derivative [$C_{20}H_{12}O_5$ or $O(C_6H_3OH)_2C.C_6H_4COO$] of resorcinol obtained by the condensation of resorcinol and phthalic anhydride. Fluorescein occurs as a yellowish-red to dark-red powder; odorless and tasteless. It is very slightly soluble in water or ether, soluble in alcohol. Fluorescein dissolves in solutions of alkali hydroxides or carbonates, forming a liquid which appears red when observed in transmitted light and fluorescent bright-green in reflected light. An alkaline solution of fluorescein, even when highly diluted, shows a greenish-yellow fluorescence, which is discharged by the addition of a slight excess of acid. Incinerate 1 Gm. of fluorescein; the ash does not exceed 0.0025 Gm. Heat about 1 Gm. of fluorescein at a temperature below a red heat until it is completely carbonized, then boil the powdered residue with 10 mils of diluted hydrochloric acid for five minutes, filter and wash the residue with 10 mils of distilled water. The combined filtrate, when boiled with a few drops of nitric acid, and supersaturated with ammonia and filtered, if necessary, remains clear upon the addition of an equal volume of hydrogen sulphide T.S. (*zinc*). Shake about 1 Gm. of fluorescein with 20 mils of distilled water and filter; one drop of tenth-normal sodium hydroxide V.S. imparts to 10 mils of the filtrate a bright green fluorescence. The addition of a drop of ferric chloride T.S. to the remaining portion of the filtrate does not produce a bluish coloration (*resorcinol and various other phenolic compounds*).

Fuchsin (Basic Fuchsin, Magenta, Rubin, Rosaniline).—The hydrochloride or acetate of rosaniline (triamido-diphenyl-tolyl-carbinol) frequently with the same salts of para-rosaniline (triamido-triphenyl-carbinol). In well-developed crystals or irregular crystalline fragments of a glossy, greenish-bronze luster. Soluble in water, alcohol, or amyl alcohol. An aqueous solution (1 in 500), upon the addition of tannic acid T.S., yields a red precipitate. The addition of about 0.5 Gm. of zinc dust (see page 1516), and 10 mils of ammonia water to 10 mils of an aqueous solution of fuchsin (1 in 500) produces decolorization when the mixture is well shaken. Place a few drops of this decolorized solution on filter paper, and then add near by a few drops of hydrochloric acid; the zone where the two neutralizing fluids meet assumes a red color. Sulphurous acid (see page 1515), when added slowly, with agitation, to an aqueous solution of fuchsin (1 in 500) causes decolorization. The original color is restored upon the subsequent addition of a solution of formaldehyde. Upon slowly adding hydrochloric acid, to an aqueous solution of fuchsin (1 in 500), the red color gradually changes to a brownish-red which subsequently changes to a yellow when the reagent is in excess. The addition of sodium hydroxide T.S. to an aqueous solution of fuchsin (1 in 500) precipitates the red colored free base. Finely pulverized fuchsin dissolves in concentrated sulphuric acid (see page 1515) with a yellow to yellowish-brown color, which solution, upon the cautious addition of distilled water, becomes yellow to colorless.

Fuchsin, Acid (Acid Magenta, Acid Rubin, Fuchsin S).—Chiefly the acid sodium salt of fuchsin di- and tri-sulphonic acids. Acid fuchsin occurs as metallic, greenish, glistening granules or as a greenish-brown crystalline powder; soluble in water, forming a cherry-red solution, very slightly soluble in alcohol; insoluble in ether. The addition of tannic acid T.S. to an aqueous solution of acid fuchsin (1 in 500) produces no precipitation (*acid color*). The addition of about 0.5 Gm. of zinc dust and 5 mils of ammonia water to 10 mils of an aqueous solution of acid fuchsin (1 in 500) produces decolorization when the mixture is well shaken. When this mixture is filtered, the addition of hydrochloric acid to the colorless filtrate restores its original red color. This solution, when agitated with ether, imparts no color to the latter (*phthaleins*). The addition of sodium hydroxide T.S. to an aqueous solution of the salt (1 in 500) almost decolorizes the solution. The addition of hydrochloric acid to an aqueous solution (1 in 500) produces no change. It dissolves in concentrated sulphuric acid with a yellow to brownish-red color and this solution, upon the cautious addition of distilled water, changes to its original fuchsin-red color.

Fuchsin-Sulphurous Acid Test Solution.—To a solution of 0.5 Gm. of fuchsin and 9 Gm. of the sodium bisulphite (see page 1510) in 500 mils of distilled water, add 10 mils of hydrochloric acid. The quantity of sulphurous acid present should be about 5 Gm. Preserve the solution in well-stoppered bottles protected from light.

Gelatin Test Solution.—Dissolve 1 Gm. of official gelatin in 50 mils of distilled water, with the aid of a gentle heat, and filter, if necessary. This solution is to be freshly made when wanted for use.

Glass Wool (Spun Glass).—Fine threads of spun glass. Two Gm. of glass wool when digested on a bath of boiling water for one-half hour with 100 mils of diluted hydrochloric acid, the mixture filtered and the filtrate evaporated to dryness and then dried at 110° C., leaves not more than 0.01 Gm. of residue (*soluble matter*). Boil 1 Gm. of glass wool for a few minutes with a mixture of 25 mils each of diluted nitric acid and distilled water; filter, evaporate the filtrate to dryness, and treat the residue with 10 mils of distilled water and again filter it; the filtrate is not affected by the addition of hydrogen sulphide T.S. (*lead*).

Glucose, Dry (Dextrose, d-glucose), $C_6H_{12}O_6$.—A white, anhydrous powder which complies with the tests for identity and purity given under "*Glucosum.*"

Gold Chloride (Chlorauric Acid), $AuCl_3HCl + 4H_2O$.—Yellow, very hygroscopic crystals which contain about 48 per cent. of metallic gold, when assayed by moistening a weighed portion of the crystals with a slight excess of ammonium oxalate T.S., evaporating to dryness, igniting and weighing the residue. The metallic gold thus obtained does not give a positive reaction upon heating with diluted hydrochloric acid, filtering and testing the solution with either hydrogen sulphide T.S., dry glucose, or ammonium sulphide T.S.

Gold Chloride Test Solution.—Dissolve 1 Gm. of gold chloride in 30 mils of distilled water.

Gold Chloride Test Solution, Diluted.—This solution is used as a standard for the assay of the official Dried Suprarenals, and must contain 0.1 Gm. of metallic gold in each 100 mils. Accurately measure 10 mils of gold chloride test solution (see above) into a weighed porcelain crucible, add about 1 Gm. of ammonium oxalate T.S. and evaporate it to dryness; then cautiously ignite the residue until no further loss in weight occurs, and weigh. Calculate the exact amount of metallic gold present in the solution which has been assayed and then dilute the remainder with a sufficient quantity of distilled water to make each 100 mils contain 0.1 Gm. of metallic gold.

Hematein, $C_{16}H_{12}O_6$.—A product of the oxidation of hematoxylin, occurring in reddish-brown plates of a greenish metallic luster; very slightly soluble in cold water, alcohol or ether, insoluble in chloroform. It is soluble in ammonia water with a brownish-violet color and in diluted solutions of the caustic alkalies with a bright red color.

Hematoxylin and Hematoxylin Test Solution.—See under *Indicators*.

Hydrated Chloral Test Solution.—A concentrated aqueous solution prepared by dissolving 3 parts of official hydrated chloral in 2 parts of distilled water.

Hydrochloric Acid, Concentrated, for Tests, HCl.—An acid of specific gravity between 1.170 and 1.184 at 25° C. (35 to 38 per cent.), which must respond to the following tests of purity: Evaporate 100 mils of the acid to about 5 mils, dilute it with 10 mils of distilled water, and add a few drops of barium chloride T.S.; no precipitate occurs within twelve hours (*sulphuric acid*). Evaporate 50 mils of the acid to dryness on a water bath; not more than 0.002 Gm. of non-volatile residue remains (*non-volatile solids*). Add 5 mils of the concentrated acid, diluted with 50 mils of distilled water, to a solution of 1 drop of tenth-normal iodine V.S. in 50 mils of distilled water to which a few drops of starch T.S. have been added; no decolorization occurs (*sulphurous acid*). Dilute 10 mils of the acid with about 100 mils of warm distilled water (at about 50° C.) and thoroughly saturate it with hydrogen sulphide; no dark coloration or precipitate forms either before or after neutralizing with ammonia water and adding a few drops of ammonium sulphide T. S. (*heavy metals*). Two mils of the acid, diluted with 10 mils of distilled water, when subjected to the Arsenic Test (No. 1) produces a stain not greater than that produced by the zinc.

Hydrogen Sulphide, H_2S.—A gas generated by treating ferrous sulphide (see page 1499) with diluted sulphuric acid, and washing the gas as directed below under the Test Solution.

Hydrogen Sulphide Test Solution (Hydrosulphuric Acid).—A saturated, aqueous solution of hydrogen sulphide. To prepare about 1000 mils of the solution, treat 20 Gm. of ferrous sulphide in a suitable apparatus with a mixture of 20 mils of official sulphuric acid and 250 mils of distilled water, pass the gas through a drying tube filled with granulated calcium chloride, then from this through a tube of about 8 millimeters diameter and 40 centimeters in length, which contains about 5 Gm. of coarsely pulverized iodine mixed with glass wool, and finally through a wash bottle which contains a small quantity of potassium iodide T.S. The gas thus purified is conducted nearly to the bottom of a bottle of the capacity of about 1500 mils containing 1000 mils of cold distilled water. Shake the bottle occasionally to facilitate the solution of the gas. When the gas is no longer absorbed, transfer the solution to small, dark amber-colored bottles, fill nearly to the top; pass a stream of purified hydrogen sulphide for a few minutes through each, and then at once stopper them tightly, and preserve them afterwards in a cool and dark place. Do not use this solution unless it retains a strong odor of hydrogen sulphide, and, when added to an equal volume of ferric chloride T.S. produces at once a copious precipitate of sulphur.

Indicators.—See special list, page 1536.

Indigo Carmine Test Solution.—Dissolve 1 Gm. of the official sodium indigotindisulphonate in 150 mils of distilled water.

Iodeosin and Iodeosin Test Solution.—See under *Indicators*.

Iodine, Purified.—Heat powdered official iodine in a porcelain dish placed on a water bath for twenty minutes, and stir it constantly with a glass rod, so that adhering moisture, cyanogen iodide, and most of the iodine bromide and iodine chloride, if present, may be vaporized, then transfer the iodine to a porcelain or other non-metallic mortar, and triturate it with about 5 per cent. of its weight of dry potassium iodide, so as to decompose any remaining iodine bromide and iodine chloride. Then return the mixture to the dish, cover it with a glass funnel, and heat the dish carefully on a sand bath. Detach the sublimed iodine, powder it and then dry for twenty-four hours over calcium chloride. Keep the product in well-stoppered bottles, in a cool place. One Gm. of iodine, thus purified, leaves no weighable residue when sublimed.

Iodine Test Solution.—Dissolve 1 Gm. of official iodine and 3 Gm. of potassium iodide in 50 mils of distilled water.

Iodo=bromide Test Solution.—(See Iodine Absorption Value Test No. 8.) Dissolve 13.2 Gm. of powdered iodine (see page 686) in 1000 mils of official glacial acetic acid with the aid of a gentle heat, if necessary, to facilitate solution. Cool the solution to 25° C. and determine the iodine content in 20 mils of the solution by means of tenth-normal sodium thiosulphate V.S.; then add to the solution a quantity of bromine (see page 1495) molecularly equivalent to that of the iodine present (3 mils being the usual approximate amount). Keep the solution in glass-stoppered bottles, protected from light.

Iron, Metallic, Fe.—Bright and perfectly clean iron in the form of wire, sheet, filings, or powder (electrolytically reduced). For making solutions of pure iron salts, fine, thin, bright wire (so-called "florist's" or "piano wire") is used. For detecting copper use bright pieces of sheet iron or steel needles.

Lævo-methylamino-ethanol-catechol, $C_9H_{13}O_3N$.—A nearly white to light brown micro-crystalline powder. Very slightly soluble in water; almost insoluble in alcohol (90 per cent.), in ether, and in chloroform. Combines with acids to form salts which are readily soluble in water and in alcohol (90 per cent.). Melts, with partial decomposition, between 205° and 212° C. Alkaline to moistened litmus paper. A dilute, slightly acidified solution gives with a trace of ferric chloride an emerald-green color which is changed to purple or carmine by the cautious addition of a dilute solution of sodium hydroxide. It readily reduces solution of gold chloride and gradually develops a characteristic, unpleasant odor when a small quantity is mixed with five times its volume of sodium hydroxide T.S. It yields no precipitate with potassio-mercuric iodide T.S. (*absence of most alkaloids*). No weighable ash is obtained on ignition of 0.2 Gm.

Lead Acetate Glass Wool.—Immerse glass wool in a mixture of equal parts of lead acetate T.S. and distilled water and remove the excess of liquid by pressing it between filter paper. Prepare the glass wool, as just described, immediately before it is required in the test.

Lead Acetate Test Paper.—Immerse strips of heavy white filter paper, 6 cm. in width and 8 cm. in length, in a mixture of equal parts of lead acetate T.S. and distilled water, drain off the excess of liquid and dry the paper on glass in an oven at 100° C., avoiding contact with metal.

Lead Acetate Test Solution.—Dissolve 10 Gm. of clear, transparent crystals of official lead acetate, free from adhering lead carbonate, in sufficient distilled water to measure 100 mils. Preserve the solution in well-stoppered bottles.

Lead Acetate Test Solution, Alcoholic.—Dissolve 3 Gm. of clear transparent crystals of official lead acetate, free from adhering lead carbonate, in sufficient alcohol to measure 100 mils. Preserve the solution in well-stoppered bottles.

Lead Acetate Test Solution, Basic.—Use the official solution of lead subacetate.

Lead Nitrate, $Pb(NO_3)_2$.—Colorless, octahedral crystals, transparent or opaque. Soluble in 1.85 parts of water at 25° C., in 0.75 part of boiling water, and almost insoluble in alcohol. Lead nitrate responds to the tests of identity for lead and freedom from foreign metals directed under *Plumbi Acetas*.

Lead Peroxide (Lead Dioxide), PbO_2.—A dark brown powder containing not less than 90 per cent. of lead peroxide. Insoluble in nitric acid; when warmed with hydrochloric acid, it is converted into lead chloride with the evolution of chlorine; when heated alone or with sulphuric acid, lead peroxide gives off oxygen. It is dissolved by concentrated solutions of potassium or sodium hydroxide. Dissolve by agitation about 0.5 Gm. of finely powdered lead peroxide, previously dried to constant weight at 100° C. and accurately weighed, in a solution of 1.5 Gm. of official potassium iodide and 12 Gm. of official sodium acetate in 8 mils of official glacial acetic acid diluted with an equal volume of distilled water. Should the resulting solution be turbid, add further small portions of sodium acetate until clear. Then determine the liberated iodine by titrating with tenth-normal sodium thiosulphate V.S., starch T.S. being used as indicator. It shows not less than 90 per cent. of PbO_2. Each mil of tenth-normal sodium thiosulphate V.S. is equivalent to 0.01195 Gm. of PbO_2.

Lime, Freshly Slaked.—To prepare freshly slaked lime for the Opium Assay, drop upon a convenient quantity of lime one-third of its weight of water, cover it and allow it to stand until the lime is slaked and cooled.

Litmus Paper and Test Solution.—See under *Indicators*.

Magnesia Mixture Test Solution.—Dissolve 5.5 Gm. of magnesium chloride, and 7 Gm. of official ammonium chloride in 65 mils of distilled water, add 35 mils of official ammonia water, set the mixture aside for a few days in a well-stoppered vessel, and filter. If not perfectly clear, filter the solution before using.

Magnesium Chloride, $MgCl_2 + 6H_2O$.—White, deliquescent crystals, soluble in about 0.6 per cent. of cold water and about 5 parts of alcohol, leaving no insoluble residue. Ten mils of an aqueous solution (1 in 20) shows no precipitate upon the addition of a few drops of diluted sulphuric acid (*barium*), nor after the addition of 10 mils of ammonium chloride T.S. followed by a few drops of ammonia water and 5 mils of ammonium oxalate T.S. (*calcium*), nor after the addition of ammonium sulphide T.S. (*heavy metals*).

Magnesium Sulphate Test Solution.—Dissolve 10 Gm. of official magnesium sulphate in sufficient distilled water to measure 100 mils.

Manganese Sulphate, $MnSO_4$.—Containing from 4 to 5 molecules of water of crystallization (depending on the temperature at which it is crystallized), forming pale rose-red crystals, slightly efflorescent in the air, soluble in about 1 part of water, insoluble in alcohol. Its aqueous solution (1 in 20) yields with barium chloride T.S. a white precipitate insoluble in hydrochloric acid, and with ammonium sulphide T.S. a salmon colored precipitate. Dissolve 1 Gm. of the salt in 50 mils of distilled water, add 0.5 mil of hydrochloric acid (see page 659) and a few drops of chlorine water (see page 1496), boil for a few minutes and cool. On now adding 1 mil of potassium sulphocyanate T.S. to this solution no red color is produced. Dissolve 1 Gm. of the salt in 50 mils of distilled water, add about 10 mils of ammonium chloride T.S., heat to boiling, and precipitate the manganese with ammonium sulphide T.S., continuing the heating until the precipitate acquires a greenish color, then filter, evaporate the filtrate to dryness and ignite; not more than 0.5 per cent. of residue remains (*calcium, magnesium, or alkali metals*).

Manganese Sulphate Test Solution.—Dissolve 10 Gm. of manganese sulphate in 50 mils of distilled water, and add sufficient diluted sulphuric acid to make 100 mils.

Mercuric Bromide, $HgBr_2$.—White rhombic needles or prisms or lustrous scales or a granular, crystalline powder, fusing at about 325° C. and subliming without decomposition. Soluble in 200 parts of water at 25° C. and in 25 parts of boiling water; readily soluble in boiling alcohol.

Mercuric Bromide Test Paper.—Cut stiff, heavy quantitative filter paper (see Filter Paper, Quantitative) into strips 3 mm. in width and about 12 cm. in length. Immerse these strips for five minutes in alcoholic mercuric bromide T.S. (see below). Remove the excess of solution by pressing the strips between filter paper and then dry them quickly on glass in an oven heated to 100° C. Place the strips at once in a wide-mouthed bottle and stopper it securely.

Mercuric Bromide Test Solution, Alcoholic.—Dissolve 5 Gm. of mercuric bromide in 100 mils of alcohol, employing a gentle heat to facilitate solution. Keep it in glass-stoppered bottles protected from the light.

Mercuric Chloride Test Solution.—Dissolve 5 Gm. of official corrosive mercuric chloride in sufficient distilled water to measure 100 mils.

Mercuric Nitrate Test Solution, $Hg(NO_3)_2$.—Mix 45 Gm. of official nitric acid with 15 mils of distilled water and dissolve 40 Gm. of official red mercuric oxide in the mixture. Keep the solution in glass-stoppered bottles.

Mercuric Potassium Iodide Test Solution (*Mayer's Reagent*).—Dissolve 1.358 Gm. of official corrosive mercuric chloride in 60 mils of distilled water, and 5 Gm. of official potassium iodide in 10 mils of distilled water. Mix the two solutions, and then add sufficient distilled water to measure 100 mils.

Mercuric Potassium Iodide Test Solution, Alkaline (*Nessler's Reagent*).—Dissolve 10 Gm. of official potassium iodide in 10 mils of distilled water, and add gradually in portions a saturated aqueous solution of official corrosive mercuric chloride with constant agitation, until a slight red precipitate remains undissolved; to this mixture add 30 Gm. of official potassium hydroxide and, when solution has taken place, 1 mil more of the saturated aqueous solution of mercuric chloride. Dilute this solution with distilled water until it measures 200 mils. Allow the precipitate to subside, and draw off the clear fluid. Two mils of this reagent, when added to 50 mils of distilled water containing 0.05 milligramme of ammonia, produces at once a yellowish-brown coloration.

Mercurous Nitrate Test Solution, $HgNO_3$.—Mix 10 Gm. of pure mercury (see page 914) with 5 mils of official nitric acid and 5 mils of distilled water, in a porcelain evaporating dish and set it aside for twenty-four hours in a cool, dark room. Separate and drain the crystals of mercurous nitrate, and dissolve them in 100 mils of distilled water. Preserve the solution in a dark amber-colored bottle in which a small quantity of mercury has been placed.

Methyl Orange and Methyl Orange Test Solution.—See under *Indicators.*

Methyl Red and Methyl Red Test Solution.—See under *Indicators.*

Methyl Violet 6B (Paris Violet 6B).—A mixture of penta- and hexa-methyl-para-rosaniline chlorides. A very dark greenish powder which dissolves readily in water or alcohol, yielding a deep violet solution. Its solution in alcohol or chloroform has a deeper blue color than the aqueous solution. Insoluble in ether. An aqueous solution of methyl violet (1 in 500) when added drop by drop to tannic acid T.S. forms a deep blue precipitate (*basic color*). The addition of a few drops of hydrochloric acid to a mixture of about 0.5 Gm. of zinc dust and 5 mils of an aqueous solution of methyl violet (1 in 500) causes rapid decolorization. Place a few drops of this decolorized solution near a few drops of ammonia water on filter paper; the zone of contact assumes a blue color. Add hydrochloric acid slowly, drop by drop, with agitation, to an aqueous solution of the salt (1 in 500); the violet color gradually changes to blue-green, green, and finally to brownish-yellow, the solution remaining clear. Upon gradually diluting this solution with distilled water, the color changes take place in the reverse order. Add 5 mils of sodium hydroxide T.S. to 5 mils of an aqueous solution of methyl violet (1 in 500); a blue precipitate gradually forms and upon heating, the mixture becomes colorless and deposits white floccules. Concentrated sulphuric acid dissolves methyl violet with an orange to brownish-red color; upon slowly diluting this solution with distilled water, the solution assumes a brown, then green, and finally a blue color. Incinerate 1 Gm. of methyl violet; not more than 0.01 Gm. of ash remains.

Methylene Green (Mono-nitro-methylene blue, Tetra-methyl-mono-nitro-thioninchloride), $(CH_3)_2.N.C_6H_3 : N(S)C_6H_2(NO_2).N.(CH_3)_2Cl$.—A very dark brown to gray-black powder; soluble in water and slightly soluble in alcohol, yielding greenish-blue solutions. An aqueous solution of methylene green (1 in 500) yields a precipitate upon the addition of tannic acid T.S. The addition of 0.5 Gm. of zinc dust and 5 mils of ammonia water to 10 mils of an aqueous solution of the salt (1 in 500) and warming the resulting mixture causes decolorization. Add a few drops of solution of hydrogen dioxide to the decolorized liquid, keeping the solution alkaline; a violet color is produced. The addition of hydrochloric acid to an aqueous solution of methylene green (1 in 500) produces no change; sodium hydroxide T.S. produces a violet precipitate which dissolves upon heating (distinction from *methylene blue*). Methylene green dissolves in sulphuric acid with a green color and on cautiously diluting this solution with distilled water it changes to greenish-blue.

Molybdic Acid, H_2MoO_4.—A white to yellowish-white powder, containing about 85 per cent. of molybdic anhydride (MoO_3). One Gm. of molybdic acid yields a clear solution with 10 mils of ammonia water; the addition of an equal volume of hydrogen sulphide T.S. produces a greenish-yellow color, but no brownish-yellow color or precipitate (*heavy metals*). Pour a solution of 10 Gm. of molybdic acid in about 25 mils of ammonia water into a mixture of 75 parts of nitric acid (see page 664), and 75 parts of distilled water and set it aside for twelve hours at about 40° C.; no yellow precipitate appears (*phosphoric acid*). Prepare a solution of about 0.5 Gm. of molybdic acid, accurately weighed, in 50 mils of distilled water by the aid of about 3 mils of ammonia water, warming it to facilitate solution. Make this solution acid with acetic acid, dilute it further with 200 mils of distilled water, and heat to boiling; then add 30 mils of an aqueous solution (1 in 20), containing official lead acetate, cover the beaker and boil the liquid for several minutes, stirring occasionally to facilitate granulation of the precipitate. Wash the precipitate by decantation ten times, using 50 mils of boiling distilled water each time; collect the precipitate in a previously ignited and tared Gooch crucible containing a layer of asbestos, again wash the precipitate with boiling distilled water until the washings cease to react with hydrogen sulphide T.S., and ignite to constant weight. The amount of lead molybdate ($PbMoO_4$) obtained, multiplied by 0.39226, gives the amount of molybdic anhydride (MoO_3) present.

Naphthylamine (Alpha) Hydrochloride, $C_{10}H_7.NH_2.HCl$.—A white crystalline powder which turns bluish on exposure. Soluble in water, alcohol, or ether. For tests of identity see below, under Betanaphthylamine.

Naphthylamine (Alpha) Hydrochloride Test Solution.—Boil 0.5 Gm. of alpha-naphthylamine hydrochloride with 100 mils of distilled water, for ten minutes, keeping the volume constant and finally filter it through cotton. Employ only freshly distilled water in preparing this reagent, which must be kept in well-stoppered bottles, protected from light.

Naphthylamine (Beta) Hydrochloride, $C_{10}H_7.NH_2.HCl$.—White to yellowish, glossy scales, or flakes, soluble in about 50 parts of water and readily soluble in alcohol. The addition of one drop of ferric chloride T.S. to 10 mils of an aqueous solution of betanaphthylamine hydrochloride (1 in 100) does not produce a violet color (*alpha-naphthylamine*); the addition of a small crystal of sodium nitrite to an aqueous solution of betanaphthylamine hydrochloride (1 in 100) produces an orange precipitate, not a dark red precipitate (distinction from *alpha-naphthylamine*).

Nitric Acid, HNO_3.—Use the official nitric acid.

Nitric Acid, Diluted.—Add 50 Gm. of official nitric acid to 290 Gm. of distilled water. It contains not less than 9.5 per cent. nor more than 10.5 per cent. of HNO_3. Diluted nitric acid to which an equal volume of distilled water has been added is not affected upon the addition of barium nitrate T.S. (*sulphuric acid*), or of silver nitrate T.S. (*hydrochloric acid*). Dilute about 20 mils of diluted nitric acid, accurately weighed, with 10 mils of distilled water and titrate with normal potassium hydroxide V.S., methyl orange T.S. being used as indicator. It shows not less than 9.5 per cent. nor more than 10.5 per cent. of HNO_3.

Nitric Acid, Fuming.—Use the commercial red fuming acid, if it is of a specific gravity between 1.48 and 1.52 at 25° C. Preserve it carefully in glass-stoppered bottles, in a cool place. It should conform to the tests for purity given under *Acidum Nitricum.*

Oil of Cedarwood (for use with the microscope).—For clearing microscopic sections, a selected commercial distilled oil from the wood of the Red Cedar, *Juniperus Virginiana* Linné (Fam. *Pinaceæ*) should be used. Such oil should have a refractive index of about 1.504 at 20° C. For use with homogeneous immersion lenses, a specially prepared oil is required, having a refractive index of exactly 1.515 at 18° C.

Orange G (the sodium salt of azo-benzene-beta-naphthol disulphonic acid), $C_6H_5.:N.C_{10}H_4(OH)(SO_3Na)_2(2.6.8)$.—Orange to brick-red powder, or dark red crystals; readily soluble in water, yielding an orange-yellow solution, slightly soluble in alcohol, insoluble in ether or chloroform. The addition of tannic acid T.S. to an aqueous solution of orange G (1 in 500) causes no precipitation (*acid color*). The addition of hydrochloric acid to a mixture of 0.5 Gm. of zinc dust and 10 mils of an aqueous solution of the color (1 in 500) produces decolorization. When filtered, the colorless filtrate, on standing exposed to the air, does not regain its original color (presence of *azo-group*). When heated, orange G does not deflagrate (distinction from *nitro colors*). The addition of barium or calcium chloride T.S. to a concentrated aqueous solution of orange G produces a colored, crystalline precipitate. The addition of hydrochloric acid to an aqueous solution of the dye (1 in 500) produces no change; the addition of sodium hydroxide T.S. to a similar solution produces a yellowish-red to a bordeaux color but no precipitation. Orange G dissolves in concentrated sulphuric acid with an orange to yellowish-red color; no change in color results upon diluting the solution cautiously with distilled water.

Orcin (Orcinol; Dihydroxy-methyl-benzene 1.3.5.), $C_6H_3(CH_3).(OH).(OH).+H_2O$.—In the form of monoclinic prisms, white with a reddish tint, which fuse at about 58° to 60° C. Orcin has an intensely sweet and astringent taste; very soluble in hot water, less soluble in cold water, readily soluble in alcohol or ether. The anhydrous substance fuses between 106° and 108° C. Anhydrous crystals are deposited from an ether solution. When exposed to light or air the crystals assume a reddish-brown color. The addition of a few drops of ferric chloride T.S. to an aqueous solution of orcin (1 in 20) produces a deep blue color. Warm 10 mils of an aqueous solution of orcin (1 in 10) with 10 mils of sodium hydroxide T.S. and add a few drops of chloroform; the solution assumes a purple-red color then bright red, and, after diluting with distilled water, shows an intense, greenish-yellow fluorescence. Aqueous solutions of orcin (1 in 20) tested separately do not yield precipitates upon the addition of test solutions of either mercuric chloride, cupric sulphate, tannic acid or lead acetate; with basic lead acetate T.S., a white precipitate is obtained (characteristic of *resorcinol derivatives*). Dissolve about 1.3 Gm. of orcin, accurately weighed, in sufficient distilled water to measure 1000 mils. Introduce 25 mils of this solution, 25 mils of tenth-normal bromine V.S., and 50 mils of distilled water into a glass-stoppered flask of about 300 mils capacity, and then add 25 mils of dilute sulphuric acid T.S. After thoroughly agitating the mixture, set it aside for ten minutes, then cautiously lift the stopper, quickly introduce 2 Gm. of potassium iodide and close the flask at once. Agitate the solution and, after five minutes, determine the liberated iodine by means of tenth-normal sodium thiosulphate V.S.; conduct a blank experiment, omitting the addition of the solution of orcin and note the number of mils of tenth-normal sodium thiosulphate V.S. consumed. The difference in mils of tenth-normal sodium thiosulphate V.S. required in the original titration and the blank test, when multiplied by 0.002068, gives the quantity of anhydrous orcin present, which corresponds to not less than 85 per cent.

Ouabain.—Crystallized ouabain, frequently, though erroneously, referred to as crystallized strophanthin, or g-strophanthin Thoms. Ouabain is a glucoside, $C_{30}H_{46}O_{12} + 9H_2O$, obtained from the wood of *Acocanthera Ouabaio* Cathelineau, or from the seed of *Strophanthus gratus* Franchet. It occurs as colorless, quadratic crystals of bitter taste. It is easily soluble in hot water, soluble in 100 parts of cold water and in about 30 parts of dehydrated alcohol and in 30 parts of amyl alcohol; slightly soluble in acetic ether, ether or chloroform. A solution of 0.01 Gm. of ouabain in 1 mil of distilled water, poured over a layer of concentrated sulphuric acid colors the latter from pink to red and the aqueous layer is colored green. Heated to 105° C. it loses about 20 per cent. of water. The ouabain thus dried melts between 187° and 188° C. On igniting 0.2 Gm. no weighable ash remains. Heating with diluted hydrochloric or sulphuric acid produces hydrolytic cleavage, yielding a body which is identical with rhamnose.

Oxalic Acid, Purified, $H_2C_2O_4 + 2H_2O$.—Colorless, uneffloresced crystals, soluble in 10 parts of cold water, in about 3 parts of boiling water and in 2.5 parts of alcohol. Ten Gm. when ignited leaves not more than 0.005 Gm. of residue (*non-volatile matter*). Dissolve 2 Gm. of oxalic acid and about 3 Gm. of potassium hydroxide in 30 mils of distilled water, add to this solution about 15 drops of Nessler's Reagent (see page 1503), no brownish-red coloration develops when compared with a blank test, omitting the oxalic acid (*ammonium compound*). Preserve it in well-stoppered bottles.

Oxalic Acid Test Solution.—Dissolve 5 Gm. of purified oxalic acid (see above) in sufficient distilled water to measure 100 mils.

Palladous Chloride, $PdCl_2$.—A dark brown, hygroscopic mass, readily soluble in water.

Palladous Chloride Test Solution.—Dissolve 0.5 Gm. of palladous chloride in sufficient distilled water to measure 10 mils. Preserve the solution in a glass-stoppered bottle.

Paradimethylaminobenzaldehyde (Dimethyl - p - amino - benzaldehyde), $(CH_3)_2N.C_6H_4.CHO$.—Colorless scales fusing at 73° C.; soluble in hot water. The addition of an alcoholic solution of benzidine (1 in 100) to a slightly acidified solution of paradimethylaminobenzaldehyde produces a brick-red precipitate after standing.

Peptone (Beef Peptone).—The dried product of the pancreatic digestion of meat. A yellow powder of a slightly bitter but not disagreeable taste and an odor resembling that of meat extract. Soluble in all proportions in water, yielding a yellowish-brown liquid of faintly acid reaction. Slightly soluble in diluted alcohol, insoluble in alcohol or ether. An aqueous solution of peptone (1 in 20), upon the addition of tannic acid T.S. or mercuric chloride T.S., yields a precipitate. On the addition of 0.5 mil of potassium hydroxide T.S. to an aqueous solution of peptone (1 in 20), followed by a solution of copper sulphate (1 in 50), added drop by drop with agitation, an intense, red-violet color is produced (biuret reaction). Pour an aqueous solution of peptone (1 in 20) into an excess of alcohol, allow the resulting precipitate to settle and decant the clear supernatant liquid; the residue left on evaporating this liquid is completely soluble in alcohol and no coagulation occurs. One Gm. of peptone dissolves in 20 parts of water with but slight turbidity. When an aqueous solution of peptone (1 in 200) is heated to boiling, no precipitation occurs; the addition of nitric acid does not cause turbidity (*coagulable albumin*). Saturate an aqueous solution of peptone (0.5 Gm. in 20 mils) with powdered zinc sulphate; not more than a slight flocculent precipitate appears (*proteoses*). Dry 1 Gm. of peptone at 100° C.; it loses not more than 7 per cent. in weight; ignite this dried product; not more than 0.005 Gm. of ash remains. Peptone contains not less than 12.5 per cent. of nitrogen when determined by the Kjeldahl method, corresponding to about 78 per cent. of pure peptone.

Phenoldisulphonic Acid Test Solution (Phenol-disulphonic acid), $C_6H_3(OH)(SO_3H)_2$.—Mix 37 parts of official sulphuric acid with 3 parts of official phenol in a flask of suitable capacity and heat in a bath of boiling water for six hours. Transfer the product to a glass-stoppered bottle while still fluid, and when desired for use, warm on a water bath until liquefied.

Phenolphthalein Test Solution.—See under *Indicators*.

Phenylhydrazine, $C_6H_5.NH.NH_2$.—A colorless, or slightly yellowish, highly refractive liquid, boiling between 241° and 243° C.; congealing, when cold, to monoclinic plates fusing at about 19° C. Phenylhydrazine is slightly soluble in cold water, more soluble in hot water and readily soluble in alcohol or ether. Its solutions rapidly absorb oxygen from the air, becoming brown. Shake 2 mils of phenylhydrazine with 20 mils of 5 per cent. acetic acid; a clear solution results.

Phenylhydrazine Dihydrochloride, $C_6H_5NH.NH_2.2HCl$.—A white crystalline powder, readily soluble in water, but slowly soluble in alcohol. It melts at about 200° C. Add to an aqueous solution of phenylhydrazine dihydrochloride (1 in 10) sufficient sodium hydroxide T.S. until the reaction is alkaline; upon the addition of copper sulphate T.S., a dense red precipitate is formed. An aqueous solution of the salt (1 in 20) has an acid reaction and is clear and colorless. One Gm. of the salt when ignited leaves no weighable residue.

Phenylhydrazine Hydrochloride, $C_6H_5.NH.NH_2.HCl$.—Silky scales melting at about 225° C. Readily soluble in water or alcohol. Its aqueous solution is clear and free from suspended particles.

Phloroglucinol, $C_6H_3(OH)_3 + 2H_2O$.—A white to cream colored crystalline powder, readily soluble in water, alcohol, or ether. When rapidly heated, it melts between 217° and 219° C., or when slowly heated, between 200° and 209° C. Introduce a few crystals of phloroglucinol in a test tube with about 1 mil each of sulphuric acid and acetic anhydride and heat in boiling water for from five to ten minutes; no blue color develops (*diresorcinol*).

Phloroglucinol Test Solution.—Prepare a 3 per cent. solution of phloroglucinol in alcohol. Keep the solution protected from light.

Phosphotungstic Acid, $P_2O_5.24WO_3 + xH_2O$.—White to yellowish-green crystals efflorescing slightly in air. Readily soluble in water or alcohol and slightly soluble in ether. To a solution of 1 Gm. of phosphotungstic acid in 10 mils of distilled water, add 0.1 Gm. of sodium chloride and about 3 drops of indigo T.S. followed by about 10 mils of sulphuric acid, cautiously added; then allow the liquid to stand for ten minutes, the blue color does not disappear (*nitrate*). When 1 Gm. of phosphotungstic acid is dissolved in 10 mils of distilled water and boiled, and a small piece of sodium hydroxide added (about 2 Gm.) and the solution warmed, ammonia is not evolved (*ammonium salts*).

Picric Acid Test Solution.—See *Trinitrophenol Test Solution.*

Platinic Chloride (Chloroplatinic Acid), $H_2PtCl_6 + 6H_2O$.—A brownish-red, hygroscopic, crystalline mass, soluble in water, alcohol, or ether, with a yellow color. One Gm. is completely soluble in 10 mils of dehydrated alcohol. Its aqueous solution should be yellow and not brownish. When platinic chloride is strongly ignited in a porcelain crucible, not less than 37.6 per cent. of residue remains. Digest this residue with about ten times its weight of a mixture of five volumes of nitric acid and ten volumes of distilled water on a water bath for fifteen minutes, filter, evaporate to dryness and ignite to constant weight; a residue not exceeding 0.15 per cent. of the platinic chloride taken remains (*other metals*).

Platinic Chloride Test Solution.—Dissolve 2.6 Gm. of platinic chloride in 20 mils of distilled water.

Potassio-Mercuric Iodide Test Solution.—See *Mercuric Potassium Iodide Test Solution.*

Potassium Bitartrate, $KHC_4H_4O_6$.—Purify the official potassium bitartrate to render it suitable for standardizing volumetric solutions of potassium and sodium hydroxide, as follows: To 100 Gm. of the salt, contained in a beaker, add a mixture of 85 mils of distilled water and 25 mils of diluted hydrochloric acid; place the covered beaker on a water bath and digest the mixture, with occasional stirring for three hours. Quickly cool the mixture, drain the solution from the precipitate, wash the latter by affusion and decantation with two successive portions of 100 mils each of distilled water, collect the precipitate on a plain filter, and continue the washing with cold distilled water until the filtrate, after adding a few drops of nitric acid, ceases to become opalescent upon the addition of silver nitrate T.S. Then dissolve the precipitate of potassium bitartrate in the smallest possible volume of boiling distilled water (about 1500 mils), filter, and constantly stir the filtrate while being rapidly cooled. When the mixture is cold, collect the crystalline precipitate on a plain filter, wash it with 300 mils of cold distilled water, and, after thoroughly draining, dry it at 120° C. until of constant weight. Preserve it in dry, securely stoppered bottles. Purified potassium bitartrate is employed for standardizing normal and tenth-normal potassium and sodium hydroxide V.S.

Potassium Bromate, $KBrO_3$.—White cubical crystals or a granular crystalline powder, having a pungent, saline taste. Soluble in 15.5 parts of water at 25° C., and in 2 parts of boiling water, slightly soluble in alcohol. An aqueous solution has a neutral reaction, and does not at once produce a yellow color upon the addition of diluted sulphuric acid (*bromide*). When heated to 350° C., the salt undergoes decomposition with the evolution of oxygen. Potassium bromate should not be triturated or heated with organic or easily oxidizable substances. The addition of nitric acid or sulphuric acid to the salt causes decomposition with the evolution of bromine. Dissolve 0.1 Gm. of potassium bromate, dried at 100° C., and 3 Gm. of potassium iodide, in about 25 mils of distilled water contained in a glass-stoppered bottle of suitable size, and, after the addition of 5 mils of hydrochloric acid, stopper the bottle securely, and set it aside for ten minutes. Not less than 35.85 mils of tenth-normal sodium thiosulphate V.S. is required to discharge the color, corresponding to 99.8 per cent. of $KBrO_3$.

Potassium Carbonate Test Solution.—Heat about 15 Gm. of official potassium carbonate in a crucible, gradually raising the temperature to 130° C., cool it in a desiccator, weigh off 10 Gm. of the residue, and dissolve it in sufficient distilled water to measure 100 mils.

Potassium Chromate, K_2CrO_4.—Yellow rhombic crystals, soluble in 1.6 parts of water, insoluble in alcohol. Add a few drops of silver nitrate T.S. to 10 mils of an aqueous solution of the salt (1 in 10) followed by 10 mils of nitric acid, and warm to about 50° C.; no turbidity appears (*chloride*). Another 10 mils of a solution of the same strength when mixed with an equal volume of diluted hydrochloric acid does not become turbid after the addition of barium chloride T.S. (*sulphate*). Ten mils of an aqueous solution of salt (1 in 10) does not become turbid upon the addition of 5 mils of ammonia water, followed by 2 mils of ammonium oxalate T.S. (*alkali earths*). A solution of 0.1 Gm. of the salt in 20 mils of distilled water does not become red upon the addition of a few drops of phenolphthalein T.S. (*free alkali*).

Potassium Chromate Test Solution.—Dissolve 10 Gm. of potassium chromate in sufficient distilled water to measure 100 mils.

Potassium Dichromate, Purified. (Potassium Bichromate), $K_2Cr_2O_7$.—This salt must conform to the following tests before it can be used in the preparation of the tenth-normal volumetric solution: To a solution of 5 Gm. of the salt in 100 mils of distilled water, add 30 mils of concentrated hydrochloric acid (see page 1501), followed by 5 mils of barium chloride T.S.; no turbidity appears after standing twelve hours (*sulphate*). To a solution of 5 Gm. of the salt in 60 mils of distilled water add 1 mil of ammonium chloride T.S. followed by ammonia water until alkaline (about 10 mils) and boil the liquid; no precipitation takes place after standing twelve hours (*aluminum*). The further addition of ammonium oxalate T.S. to the solution, which should still be alkaline, produces neither turbidity nor the slightest precipitation after standing twelve hours (*alkali earths*). Add 10 mils of nitric acid to a solution of 1 Gm. of the salt in 20 mils of distilled water and heat it to about 50° C.; no turbidity develops within five minutes after the addition of a few drops of silver nitrate T.S. (*chloride*).

Potassium Dichromate Test Solution.—Dissolve 10 Gm. of purified potassium dichromate in sufficient distilled water to measure 100 mils.

Potassium Ferricyanide, $K_3Fe(CN)_6$.—Dark red crystals soluble in about

2.5 parts of cold water and in 1.5 parts of boiling water. Its aqueous solution undergoes decomposition upon standing, hence its solution must be freshly made when required for use. Potassium ferricyanide when added to ferrous salts yields a blue precipitate (Turnbull's Blue); when added to solutions of ferric salts it yields clear brown solutions.

Potassium Ferricyanide Test Solution.—Dissolve 1 part of potassium ferricyanide in about 10 parts of distilled water. This solution should be freshly made when required, as it undergoes decomposition with formation of ferrocyanide on standing. A freshly prepared aqueous solution mixed with ferric chloride T.S. which has been well diluted with distilled water shows a brown tint, free from turbidity or a shade of green.

Potassium Ferrocyanide, $K_4Fe(CN)_6 + 3H_2O$.—Yellow, soft, transparent crystals which are slightly efflorescent on exposure to air. Readily soluble in hot or cold water, insoluble in alcohol. A freshly prepared aqueous solution of the salt (1 in 20) is neutral to litmus; such a solution yields a blue precipitate with solutions of ferric salts, a reddish-brown precipitate with copper sulphate T.S., and a white precipitate with lead acetate T.S. or silver nitrate T.S.

Potassium Ferrocyanide Test Solution.—Dissolve 10 Gm. of potassium ferrocyanide in sufficient distilled water to measure 100 mils.

Potassium Hydroxide Test Solution.—Use the official solution of potassium hydroxide.

Potassium Hydroxide Test Solution, Alcoholic.—Use the half-normal alcoholic potassium hydroxide V.S.

Potassium Hydroxide Test Solution, Special.—This solution is to be prepared of the same strength as *Liquor Potassii Hydroxidi,* employing potassium hydroxide which, in addition to the tests prescribed under *Potassii Hydroxidum,* complies with the following: Dissolve 1 Gm. of the potassium hydroxide in 20 mils of distilled water, in a test tube about 2 cm. in diameter, add 5 mils of nitric acid, followed by a few drops of silver nitrate T.S.; not more than a slight opalescence is produced.

Potassium Iodide Test Solution.—Dissolve 20 Gm. of official potassium iodide in sufficient distilled water to measure 100 mils, and preserve the solution in dark, amber-colored, well-stoppered bottles. The solution should be frequently renewed.

Potassium Nitrate, KNO_3.—In addition to the tests prescribed for the official *Potassii Nitras,* this salt, for use as a reagent, must conform to the following tests: To a solution of 1 Gm. of potassium nitrate in 20 mils of distilled water, add 1 mil of nitric acid followed by a few drops of silver nitrate T.S.; no opalescence results (*chloride*). To a solution of 2 Gm. of the salt in 50 mils of distilled water, add 1 mil of hydrochloric acid, followed by barium chloride T.S.; no precipitate forms after standing for several hours (*sulphate*).

Potassium Permanganate Test Solution, $KMnO_4$.—Use the tenth-normal potassium permanganate V.S.

Potassium Sulphate, K_2SO_4.—Hard, colorless, transparent prisms, or a white powder, odorless and having a somewhat bitter saline taste; permanent in the air. Soluble in about 9 parts of water at 25° C., and in 4 parts of boiling water. A saturated aqueous solution of the salt, which is neutral to litmus, yields a white, crystalline precipitate with an excess of sodium bitartrate T.S. An aqueous solution of the salt (1 in 20) yields with barium chloride T.S. a heavy white precipitate, insoluble in hydrochloric acid. An aqueous solution of potassium sulphate (1 in 20), slightly acidulated with hydrochloric acid, does not respond to the Test for heavy metals (see Test No. 3). Five mils of an aqueous solution of the salt (1 in 30) does not exceed the limit for arsenic when subjected to the Test for arsenic (see Test No. 1).

Potassium Sulphate Test Solution.—Dissolve 1 Gm. of potassium sulphate in sufficient distilled water to measure 100 mils.

Potassium Sulphocyanate (Potassium Thiocyanate), KCNS.—Colorless, hygroscopic, prismatic crystals. Readily soluble in less than its own weight of water; soluble in 10 parts of boiling dehydrated alcohol, yielding a clear solution. An aqueous solution of the salt (1 in 20) does not become turbid upon the addition of a few drops of concentrated hydrochloric acid (see page 1501), followed by barium chloride T.S. (*sulphate*). An aqueous solution of the salt (1 in 20), after the addition of 1 mil of diluted hydrochloric acid, remains colorless (*iron*), and does not respond to the Test for heavy metals (see Test No. 3).

Potassium Sulphocyanate Test Solution.—Use the tenth-normal potassium suphocyanate V.S.

Pyrogallol Test Solution, Alkaline.—Dissolve 0.5 Gm. of official pyrogallol in 2 mils of distilled water and 12 Gm. of official potassium hydroxide in 8 mils of distilled water. Mix the solutions immediately before using.

Resorcinol Test Solution.—Dissolve 1 Gm. of official resorcinol in sufficient concentrated hydrochloric acid (see page 1501) to make 100 mils.

Rosaniline Acetate, $C_{19}H_{18}N_3.C_2H_4O_2$.—The acetate of rosaniline (see *Fuchsin*). Rosaniline acetate complies with all of the tests of identity and purity given under *Fuchsin.*

Rosolic Acid and Rosolic Acid Test Solution.—See under *Indicators.*

Sawdust, Purified.—Moisten 1000 Gm. of oak sawdust, in approximately No. 20 powder, with water, pack in a cylindrical percolator and pour on enough of a 1 per cent. solution of sodium hydroxide to saturate the powder and leave a stratum above it.

When the liquid drops from the percolator, close the lower orifice and macerate the sawdust during twenty-four hours. Then proceed to percolate slowly until the alkaline percolate measures 5000 mils. Now continue the percolation with 4000 mils of 1 per cent. hydrochloric acid and then with the water until the acid is all removed and the percolate is neutral. Finally dry the powder.

Selenous Acid, H_2SeO_3.—Colorless, prismatic or granular crystals, efflorescent in dry air and hygroscopic in moist air; readily soluble in water or alcohol. Red amorphous selenium is precipitated from aqueous solutions of selenous acid upon the addition of stannous chloride T.S. or sulphurous acid.

Silver Ammonium Nitrate Test Solution.—Dissolve 1 Gm. of official silver nitrate in 20 mils of distilled water, and add ammonia water, drop by drop, agitating the mixture, until the precipitate first produced is almost, but not entirely, redissolved. Filter the solution and preserve it in dark amber-colored and well-stoppered bottles.

Silver, Metallic, Ag.—In the form of foil, wire or powder. Dissolve 2 Gm. of the metal in the smallest possible quantity of official nitric acid previously mixed with an equal volume of distilled water; no residue remains and the solution, after warming to remove the oxides of nitrogen, and diluting with fifty volumes of distilled water, remains colorless and clear. Add sufficient hydrochloric acid to this solution heated to boiling to precipitate the silver, filter, evaporate the filtrate to dryness and gently ignite the residue; not more than 0.0005 Gm. of residue remains (*foreign metals*), allowance being made for the non-volatile matter present in the water, reagents and extracted from the filter paper.

Silver Nitrate Test Solution.—For ordinary purposes, use the tenth-normal silver nitrate V.S.

Silver Sulphate, Ag_2SO_4.—Small, white, anhydrous, lustrous rhombic crystals soluble in about 87 parts of cold water. It should correspond to the tests for purity given under the official *Argenti Nitras.*

Silver Sulphate Test Solution.—Mix 1 Gm. of silver sulphate with 100 mils of distilled water in a glass-stoppered bottle and shake the mixture thoroughly. Decant the clear liquid when required for use. Alternative process: Dissolve 1 Gm. of official silver nitrate in 0.5 mil of warm distilled water, and add 1.5 mils of official sulphuric acid; on cooling, small transparent crystals of silver sulphate, Ag_2SO_4, separate. Pour off the acid liquid carefully, wash the crystals repeatedly by decantation with cold distilled water, transfer them to a bottle, add 100 mils of distilled water, and shake thoroughly until the liquid is saturated. For use, decant a sufficient quantity of the solution.

Sodium Acetate, Anhydrous, CH_3COONa.—Heat official sodium acetate gently in a porcelain dish until fusion takes place and the salt becomes a pasty mass, then gradually increase the temperature, with caution, stirring constantly, until it again fuses, and continue the heat until a dry powder results. Care must be taken to avoid charring and the salt must be constantly stirred to prevent the adhesion of the mass to the sides of the dish.

Sodium Acetate Test Solution.—Dissolve 10 Gm. of official sodium acetate in sufficient distilled water to measure 100 mils.

Sodium Bisulphite, $NaHSO_3$.—It contains not less than 90 per cent. of $NaHSO_3$. Opaque, prismatic crystals, or a granular powder, having the odor of sulphur dioxide, and a disagreeable, sulphurous taste. Exposed to the air, the salt loses sulphur dioxide and is gradually oxidized to sulphate. Soluble in 3.5 parts of water, and in 70 parts of alcohol at 25° C. Dissolve 1 Gm. of sodium bisulphite in 10 mils of diluted nitric acid and heat the solution sufficiently to expel the gases; the liquid does not become turbid (*thiosulphate*). Dissolve 1 Gm. of the salt in 20 mils of diluted hydrochloric acid, and heat it sufficiently to expel the sulphur dioxide; the remaining solution, after being restored to its original volume, does not respond to the Test for heavy metals (see Test No. 3). Transfer about 0.2 Gm. of sodium bisulphite, accurately weighed, to a glass-stoppered flask containing 50 mils of tenth-normal iodine V.S., and allow to stand with occasional agitation, until the salt is dissolved. Then titrate the excess of iodine with tenth-normal sodium thiosulphate V.S. It shows not less than 90 per cent. of $NaHSO_3$. Each mil of tenth-normal iodine V.S. corresponds to 0.005204 Gm. of $NaHSO_3$.

Sodium Bisulphite Test Solution.—Dissolve 30 Gm. of sodium bisulphite in sufficient distilled water to measure 100 mils. Should the solution possess a strong odor of sulphur dioxide, add a 20 per cent. aqueous solution of sodium hydroxide, drop by drop, until the odor becomes scarcely perceptible. The solution must be freshly prepared when needed.

Sodium Bitartrate, $NaHC_4H_4O_6 + H_2O$.—White rhombic crystals or powder, soluble in 9 parts of cold and 1.8 parts of boiling water. When assayed and tested as directed under the official *Potassii Bitartras*, it complies with the standards of purity there required. One mil of normal potassium hydroxide V.S. corresponds to 0.19006 Gm. of sodium bitartrate ($NaHC_4H_4O_6 + H_2O$).

Sodium Bitartrate Test Solution.—Dissolve about 9 Gm. of sodium bitartrate in 100 mils of distilled water. Alternative method: To a solution of 3.5 Gm. of official tartaric acid in about 80 mils of boiling distilled water, add gradually in small portions official monohydrated sodium carbonate until the solution has a neutral reaction to litmus paper. To the solution add 3.5 Gm. of tartaric acid, filter, and add sufficient distilled water to make the solution measure 100 mils. This solution must be freshly prepared when required.

Sodium Carbonate.—Use the official monohydrated sodium carbonate.

Sodium Carbonate, Anhydrous, Na_2CO_3.—This is prepared from official sodium bicarbonate which, in addition to the official requirements for purity, must conform to the following more rigorous tests before it can be employed for standardizing volumetric solutions of hydrochloric and sulphuric acids.

To a filtered solution of 5 Gm. of sodium bicarbonate in 100 mils of distilled water add an excess (5 mils) of concentrated hydrochloric acid (see page 1501), heat it to boiling, and then add 1 mil of barium chloride T.S. No cloudiness or precipitate forms within twelve hours (*sulphate*). To a solution of 1 Gm. of the bicarbonate in 30 mils of distilled water add 3 mils of official nitric acid; the solution remains clear, now heat it to boiling, and add 1 mil of silver nitrate T.S.; no opalescence appears within fifteen minutes (*chloride*). To 10 Gm. of sodium bicarbonate and about 50 mils of distilled water contained in a beaker of about 250 mils capacity, add slowly with stirring, about 30 mils of the concentrated hydrochloric acid, taking care to avoid loss through violent effervescence. Filter, wash the beaker and filter with distilled water, transfer the filtrate and washings to a platinum dish, evaporate to dryness on a water bath and dry the residue for four hours at 120° C. Now add to the dried residue about 20 mils of distilled water and about 5 mils of the concentrated hydrochloric acid, again evaporate to dryness and dry as before. Finally dissolve the residue in 3 mils of the concentrated hydrochloric acid and 50 mils of distilled water; the resulting solution remains perfectly clear upon standing (*silica*). To a solution of 1 Gm. of the bicarbonate in 15 mils of distilled water, add 2 mils of the concentrated hydrochloric acid, followed by 2 drops of nitric acid (see page 664) and boil the solution; it is not reddened upon the addition of potassium sulphocyanate T.S., a blank test being carried out at the same time (*iron*).

Take any suitable quantity of sodium bicarbonate complying with the foregoing tests, place it in a platinum vessel and heat it in an air or sand bath for one-half hour at from 270° to 280° C. (not over 300° C.). Finally cool the salt in a desiccator and, before it is quite cold, transfer it to a dry, glass-stoppered bottle.

Sodium Carbonate Test Solution.—Dissolve 10 Gm. of official monohydrated sodium carbonate in sufficient distilled water to measure 100 mils.

Sodium Chloride, NaCl.—In addition to the requirements and tests prescribed for this salt under the official *Sodii Chloridum*, it is required to conform to the following more rigorous tests before it can be used in the preparation of tenth-normal sodium chloride V.S. To a solution of 3 Gm. of sodium chloride in 80 mils of distilled water, add 1 mil of concentrated hydrochloric acid (see page 1501), heat it to boiling, and add about 5 mils of barium chloride T.S.; no precipitation of barium sulphate takes place within twenty-four hours (*sulphate*). To a solution of 3 Gm. of sodium chloride in about 10 mils of distilled water, add 5 mils of ammonia water and 5 mils of sodium phosphate T.S.; no precipitation takes place within twelve hours (*magnesium salts*). Dissolve 5 Gm. of the salt in 80 mils of distilled water, heat the solution to boiling, and add 5 mils of ammonium oxalate T.S.; no precipitate is produced within twelve hours (*calcium*); nor is this solution affected by the addition of sodium carbonate T.S.; nor is a freshly prepared solution of the same concentration affected by the addition of sodium sulphide T.S. (*alkali earths and heavy metals*). To a solution of 1 Gm. of sodium chloride in 10 mils of distilled water, add 5 mils of sodium cobaltic nitrite T.S.; no precipitation occurs after twenty-four hours (*potassium*). The addition of Nessler's Reagent to a solution of 3 Gm. of sodium chloride produces no yellow coloration (*ammonium salts*).

Sodium Cobaltic Nitrite Test Solution.—Dissolve 4 Gm. of cobaltous chloride (see page 1497) and 10 Gm. of official sodium nitrite in about 50 mils of distilled water, add 2 mils of official acetic acid and dilute with sufficient distilled water to measure 100 mils. A few drops of acetic acid should be added to the solution from time to time. The reagent must not be kept longer than three months. Should any precipitate form on standing, filter the solution.

Sodium Cyanide Test Solution.—Dissolve 1 Gm. of official sodium cyanide in sufficient distilled water to measure 10 mils. This solution must be freshly prepared when required.

Sodium Hydroxide Test Solution, NaOH.—Use the official solution of sodium hydroxide.

Sodium Hypobromite Test Solution.—To a solution of 40 Gm. of official sodium hydroxide in about 150 mils of distilled water add 10 mils of bromine (see page 1497) and, after solution has taken place, add sufficient distilled water to measure 200 mils. This solution must be freshly prepared when required for use.

Sodium Nitroprusside, $Na_2Fe(NO)(CN)_5 + 2H_2O$.—Transparent, dark red, rhombic crystals, soluble in about 2.5 parts of water. With soluble sulphides it gives an intense, violet coloration. Solutions of sodium nitroprusside must be freshly prepared when required for use.

Sodium Nitroprusside Test Solution.—Dissolve 1 part of sodium nitroprusside in 19 parts of distilled water immediately before using.

Sodium Oxalate, $Na_2C_2O_4$.—A white crystalline powder, 1 Gm. of which dissolves in about 34 mils of water at 25° C., and about 16 mils of boiling water. When used for the standardization of tenth-normal potassium permanganate V.S., sodium oxalate should comply with the following tests for purity and be dried to constant weight at 105° C. When dried to constant weight at 105° C., sodium oxalate loses not more than 0.03 per cent. in weight (*moisture*). Introduce into a conical Jena or other flask of like quality 2 Gm. of sodium oxalate, add 150 mils of distilled water and 0.2 mil of phenolphthalein T.S., boil until the volume is reduced to about 100 mils, then cool while passing a current of air free from carbon dioxide through the solution. If the solution is red, not more than 0.2 mil of fiftieth-normal sulphuric acid V.S. is required to render it colorless. If the solution is colorless, not more than 0.2 mil of fiftieth-normal potassium hydroxide V.S. is required to produce a pink color. Sodium oxalate yields an almost perfectly clear solution and contains not more than 0.01 per cent. of matter insoluble in water. Convert 10 Gm. of the salt into carbonate by ignition in a platinum crucible using an alcohol burner, dissolve the residue in distilled water by the aid of sufficient nitric acid to impart a distinctly acid reaction, heat to boiling, filter and divide into two parts. To one part, add barium nitrate T.S. and set aside for twelve hours; not more than a barely perceptible cloudiness results (*sulphate*). The remaining portion, after the addition of silver nitrate T.S., does not yield more than a faint opalescence (*chloride*). Ignite 5 Gm. of the salt to carbonate, dissolve the residue in distilled water, acidify with acetic acid and filter; after the addition of a few drops of sodium cobaltic nitrite T.S. to the filtrate it should not yield more than a faint trace of precipitate after standing for several hours (*potassium*). Ignite 5 Gm. of the salt, dissolve the residue in distilled water, acidify with hydrochloric acid and filter; the filtrate does not yield a coloration upon the addition of potassium sulphocyanate T.S. (*iron*). Heat 1 Gm. of the salt in a test tube, which has previously been rinsed with sulphuric acid, with 10 mils of sulphuric acid until fumes of sulphur trioxide appear; no discoloration of the acid is produced (*foreign organic bodies*).

Sodium Phosphate Test Solution.—Dissolve 10 Gm. of official sodium phosphate, in clear crystals, in sufficient distilled water to measure 100 mils.

Sodium Phospho-tungstate Test Solution (Sodium Phospho-wolframate).—To a solution of 20 Gm. of sodium tungstate in 100 mils of water, add sufficient official phosphoric acid to impart a strong acid reaction, filter and preserve it in an amber-colored, glass-stoppered bottle. Decant the solution from any sediment which may form.

Sodium Sulphide, $Na_2S + 9H_2O$.—Colorless, or nearly colorless, transparent crystals, of sulphuretted odor, readily soluble in water, yielding a clear solution which is alkaline to litmus.

Sodium Sulphide Test Solution.—Dissolve 10 Gm. of sodium sulphide in sufficient distilled water to measure 100 mils; filter the solution if necessary. Sodium sulphide T.S. may be used in all instances where ammonium sulphide T.S. is directed, but must be freshly prepared when required for use.

Sodium Tartrate, Neutral, $Na_2C_4H_4O_6 + 2H_2O$.—Transparent crystals soluble in 2.6 parts of water at 25° C.; insoluble in alcohol. It complies with the standards for purity required under the official *Potassii et Sodii Tartras;* each mil of half-normal sulphuric acid V.S. corresponds to 0.057515 Gm. of $Na_2C_4H_4O_6 + 2H_2O$.

Sodium Tartrate Test Solution.—Dissolve 10 Gm. of neutral sodium tartrate (see above) in sufficient distilled water to measure 100 mils. Alternative method: To a hot solution of 6.5 Gm. of the official tartaric acid, in about 80 mils of boiling distilled water, add gradually, in small portions, official monohydrated sodium carbonate until the solution has a neutral reaction to litmus paper; after filtering and cooling, add sufficient distilled water to measure 100 mils.

Sodium Thiosulphate, $Na_2S_2O_3 + 5H_2O$.—In addition to the tests prescribed for this salt under the official *Sodii Thiosulphas* it is required to conform to the following more rigorous tests before it can be used in preparing the standard volumetric solution. Add iodine T.S., drop by drop, to a solution of the salt (1 in 20) in distilled water until it retains a faint but permanent yellow color; no turbidity is produced upon the addition of barium chloride T.S. (*sulphate and sulphite*). The addition of phenolphthalein T.S. to 10 mils of an aqueous solution of the salt (1 in 10) produces no pink coloration (*free alkalies*).

Sodium Thiosulphate Test Solution.—Use tenth-normal sodium thiosulphate V.S.

Sodium Tungstate (Sodium Wolframate), $Na_2WO_4 + 2H_2O$.—Colorless prisms or plates, soluble in about 4 parts of water, forming a solution which is alkaline to litmus. Evaporate a solution of 1 Gm. of sodium tungstate in 10 mils of distilled water and 10 mils of concentrated hydrochloric acid (see page 1501) to dryness on a water bath and then heat it for half an hour at 120° C. Treat the residue with 20 mils more of the hydrochloric acid, evaporate and heat as before, and repeat the operation three times. After cooling, digest the residue with a solution of ammonium nitrate (1 in 10) to which a few drops of nitric acid have been added, transfer it to a filter, wash the insoluble tungstic acid with diluted nitric acid, dry, ignite and weigh. (It is preferable to moisten this residue with a few drops of nitric acid and repeat the ignition.) This residue weighs not less than 0.69 Gm.

Stannous Chloride, $SnCl_2 + 2H_2O$.—Colorless crystals, readily soluble in water or alcohol. When in contact with the air or excess of water, the salt readily forms a basic chloride, hence, when dissolved, its solutions should be acidulated with hydrochloric acid. When tested for arsenic as directed under the Test for arsenic (see Test No. 1), 0.3 Gm. of stannous chloride produces no stain. A solution of 2 Gm. of stannous chloride, in 1 mil of distilled water and 0.5 mil of hydrochloric acid, does not become opalescent on diluting with 20 mils of distilled water (*lead*). Alternative method: Heat tin (see page 1515) for several days with concentrated hydrochloric acid (see page 1501) upon a water bath, taking care that the metal is in excess. When the acid has become saturated, pour off the clear fluid from the undissolved tin or precipitate, filter it while still hot through asbestos and set it aside until crystallization takes place. Break up the crystals, drain, and dissolve them at once as directed under the Test Solution.

Stannous Chloride Test Solution.—Dissolve 1 Gm. of stannous chloride crystals (see above) in 10 mils of distilled water to which a few drops of hydrochloric acid have been added to prevent the precipitation of basic chloride, and preserve the solution in a glass-stoppered bottle in which a fragment of tin (see page 1515) has been placed. The solution must be renewed at frequent intervals.

Stannous Chloride Test Solution, Acid.—Dissolve 40 Gm. of stannous chloride crystals (see above) in 60 mils of concentrated hydrochloric acid (see page 1501) and preserve it in a glass-stoppered bottle.

Stannous Chloride Test Solution, Saturated.—(For Bettendorf's Arsenic Test, see Test No. 2.) Prepare a saturated solution of stannous chloride crystals (see above) in concentrated hydrochloric acid (see page 1501) or evaporate a solution prepared from metallic tin by the alternative method under *Stannous Chloride* (see above) to a specific gravity of about 2.00 at 25° C. After filtering the solution through asbestos it is transparent and has not more than a pale yellow color.

Starch (Potato).—The starch grains separated from the tubers of *Solanum tuberosum*, Linné (Fam. *Solanaceæ*). In a more or less finely granular powder, consisting of starch grains varying in shape from somewhat spherical or ellipsoidal to characteristic, with a few two- or three-compound grains; the individual grains with a circular point of origin of growth and distinct excentral lamellæ, the larger characteristic grains varying from 0.05 to 0.125 mm. in length, and under the micropolariscope showing a distinct cross and a strong play of color when a selenite plate is used.

Starch Test Solution.—Triturate 1 Gm. of official corn starch with 10 mils of cold distilled water, add sufficient boiling distilled water with constant stirring to make about 200 mils, then boil the mixture for a few minutes until a thin, translucent fluid is obtained. This solution must be freshly prepared and filtered when required.

Succinic Acid, $H_2C_4H_4O_4$.—An organic acid obtained through the destructive distillation of amber or made synthetically. It forms colorless monoclinic prisms, soluble in about 20 parts of water, 2 parts of boiling water, 10 parts of alcohol, or 18 parts of acetone; very slightly soluble in ether and insoluble in chloroform or benzene. Succinic acid melts at about 182° C.

Sulphanilic Acid (Para-amidobenzenesulphonic Acid), $C_6H_4(NH_2)(SO_3H)\ 1:4 + 2H_2O$.—Colorless, acicular, efflorescent crystals. When strongly heated, it carbonizes. Soluble in about 150 parts of cold water and insoluble in alcohol or ether.

Sulphanilic Acid Test Solution.—Dissolve 0.5 Gm. of sulphanilic acid in a mixture of 15 mils of glacial acetic acid and 135 mils of freshly distilled or recently-boiled distilled water. This reagent must be kept in well-stoppered bottles.

Sulpho-Salicylic Acid, $C_6H_3(OH)(SO_3H).COOH$.—Colorless, anhydrous needles very soluble in water and alcohol. It melts at about 120° C.

Sulphuric Acid.—Sulphuric acid of the purity required by the Pharmacopœia, with a specific gravity of 1.832 at 25° C., will be satisfactory as a reagent unless otherwise directed.

Sulphuric Acid, Fuming, $H_2SO_4 + SO_3$.—A heavy, fuming, oily liquid, sometimes slightly colored, containing from 14 to 16 per cent. of free sulphur trioxide corresponding to from 84.2 to 84.6 per cent. of total sulphuric anhydride, with a specific gravity of from 1.869 to 1.875 at 25° C. Great caution should be exercised in handling fuming sulphuric acid. Render the acid homogeneous by shaking vigorously, then transfer several mils to a glass-stoppered weighing flask and weigh accurately. Remove about 1 mil of the acid to a dish containing from 30 to 40 mils of distilled water and again accurately weigh the flask, thus noting the quantity of acid taken for the assay. Titrate the solution of the acid in the dish with normal potassium hydroxide V.S., using methyl orange T.S. as indicator. One mil of normal potassium hydroxide

V.S. corresponds to 0.040035 Gm. of sulphuric anhydride (SO_3). The percentage of SO_3 thus found, when subtracted from 100, represents the water present, for each 18.02 parts of which, 80.07 parts of SO_3 are required for the formation of H_2SO_4. After allowing for all of the water in this manner, the remaining SO_3 may be termed free SO_3.

Sulphuric Acid, Purified and Concentrated, for Tests, H_2SO_4.—When concentrated sulphuric acid is specified in a test, it is intended that the strongest purified acid of a specific gravity of not less than 1.834 at 25° C. be employed. In addition to the tests prescribed for this acid under the official *Acidum Sulphuricum,* it is required to conform to the following more rigorous tests before it can be employed as a reagent: Dilute 1 part of the acid with 4 parts of distilled water; no stain is produced by 25 mils of this diluted acid when subjected to the Test for arsenic (see Test No. 1). Dilute 1 mil of the acid with 9 mils of distilled water, cool and pour it so as to form a layer over 5 mils of diphenylamine T.S. (see page 1498); no blue color appears at the zone of contact (*nitric acid*). Upon carefully pouring about 2 mils of hydrochloric acid, in which a particle of sodium sulphite has been dissolved, over about 2 mils of the concentrated sulphuric acid, no reddish zone appears and no precipitate forms (*selenium*).

Sulphurous Acid.—An aqueous solution containing not less than 6 per cent. of sulphur dioxide. Ten mils of this solution, when mixed with 10 mils of dilute sulphuric acid (see under Arsenic Test) and evaporated on a water bath until free from sulphur dioxide, does not produce a stain when subjected to the Test for arsenic (see Test No. 1). Introduce about 2 mils of the acid into a flask containing 10 mils of distilled water, previously tared with its contents, stopper and weigh accurately. To this add 50 mils of tenth-normal iodine V.S., allow to stand five minutes, then titrate the excess of iodine with tenth-normal sodium thiosulphate V.S. It shows not less than 6 per cent. of SO_2. Each mil of tenth-normal iodine V.S. corresponds to 0.003204 Gm. of SO_2.

Tannic Acid Test Solution.—Dissolve 1 Gm. of official tannic acid in 1 mil of alcohol, and add sufficient distilled water to measure 10 mils. This test solution should be freshly prepared when needed.

Tartaric Acid Test Solution.—Dissolve 1 part of official tartaric acid in 3 parts of distilled water. This solution must be frequently renewed.

Tin, Sn.—Metallic tin in the granulated or mossy condition. Digest 5 Gm. of tin with 40 mils or a sufficient quantity of official nitric acid on a bath of boiling water until entirely converted into a white powder, then evaporate it to dryness. Stir the residue with 25 mils of diluted nitric acid (see page 1505) and 25 mils of distilled water, and filter. To the filtrate add 1 mil of diluted sulphuric acid and evaporate it as far as possible upon a water bath, and then add 10 mils of distilled water; no weighable residue remains undissolved (*lead*). When converted into stannous chloride (see page 1514), it complies with the tests directed under that salt.

Toluol (Toluene, Methyl Benzene), $C_6H_5.CH_3$.—A colorless, refractive, inflammable liquid of peculiar aromatic odor; specific gravity about 0.865 at 25° C., boiling between 110° and 112° C. Miscible with alcohol, ether, chloroform, carbon disulphide, or petroleum benzin. It dissolves phosphorus, iodine, fats, or oils.

Trinitrophenol Test Solution (Picric Acid Test Solution), $C_6H_2(NO_2)_3OH$.—Dissolve 1 Gm. of official trinitrophenol in 100 mils of distilled water by the aid of heat. Cool the solution and filter it, if necessary.

Turmeric Paper and Tincture.—See under *Indicators.*

Xylol (Xylene, Dimethyl Benzene), $C_6H_4(CH_3)_2$.—A mixture of ortho-, meta-, and para-xylene obtained through the distillation of coal tar naphtha. A colorless liquid of an odor resembling benzene. It boils between 136° and 140° C.; specific gravity about 0.850 at 25° C.; insoluble in water, but soluble in alcohol, ether, or chloroform.

Yeast.—Use the commercial compressed yeast cake.

Zinc, Zn.—Pure metallic zinc (see *Zincum,* U. S. P.).

Zinc for the Arsenic Test.—Zinc in mossy or globular form, the latter about 3 to 6 mm. in diameter, known as No. 7 Shot Zinc. This must conform with the tests for purity as given under the official *Zincum,* and in addition the following: The stain from 8 Gm. of zinc, when determined by a blank experiment as directed under the Test for arsenic (see Test No. 1) should scarcely be perceptible. Introduce 10 Gm. of the zinc into a flask of about 250 mils capacity, provided with a perforated rubber stopper and a rubber-valve tube, and containing 60 mils of distilled water, 15 mils of concentrated sulphuric acid for tests (see page 1515) and 1 drop of copper sulphate T.S. When the reaction slackens, place the flask on a water bath and warm until solution of the zinc is complete. At once begin to add tenth-normal potassium permanganate V.S., drop by drop, with agitation, until the solution assumes a faint pink tint which remains permanent for one-half minute. Not more than 1.4 mils of tenth-normal potassium permanganate V.S. is required, indicating not over 0.08 per cent. of oxidizable matter, calculated as metallic iron (Fe).

Zinc Dust (Powdered Zinc).—Zinc in the form of a fine gray powder.

Zinc Oxide, ZnO.—When used in the assay of phosphoric acid, the phosphates or the hypophosphites, it must comply with the tests given under the official *Zinci Oxidum,* and also the following: Dissolve 1 Gm. of zinc oxide in 20 mils of distilled water and 5 mils of nitric acid in a test tube about 2 cm. in diameter and add a few drops of silver nitrate T.S.; not more than a slight opalescence is produced.

Volumetric Solutions

It is absolutely necessary that the measuring vessels employed in the operations of volumetric analysis, consisting of burettes, flasks, mixing cylinders, pipettes, etc., shall agree among themselves accurately in their graduation at the standard temperature selected. All volumetric solutions should be prepared at the standard temperature of 25° C. and used in titrations, if practicable, at that standard temperature. If titrations are made at any other temperature, a volumetric solution should be used which has been standardized for such temperature. In case graduated apparatus calibrated at 25° C. is not procurable, volumetric solutions may be prepared at the temperature for which the apparatus in hand was graduated (*e.g.,* 15° C. or 20° C.), and all such volumetric solutions should be marked to indicate the temperature which has been used. Such solutions must be used as above stated at such standard temperature, care being taken that all graduated apparatus used be standardized at the same temperature.

Units of Capacity.—The units of volume employed by the Pharmacopœia must accord with its standard liter at 25° C. which represents the volume occupied by 996.04 Gm. of distilled water, weighed in air with brass weights, at a temperature of 25° C.* and barometer at 760 mm. To secure uniformity among the various forms of apparatus employed, the standard specifications of the U. S. Bureau of Standards should be adhered to as closely as possible, excepting that the temperature here adopted is 25° C.

Measuring Flasks.—Standard measuring flasks are calibrated to contain, when filled to the mark, 1000, 500, 250, 200 or 100 mils at 25° C. The necks must be of uniform calibre, and measure in diameter not less than 14 mm. nor more than 20 mm. for 1000 mil capacity; from 12 mm. to 18 mm. for 500 mil capacity; from 10 mm. to 15 mm. for 250 mil capacity, and from 8 mm. to 12 mm. for 100 mil capacity. The capacity mark on any of these flasks should not be less than 6 cm. distant from the mouth and not less than 2 cm. from the base of the neck.

Cylinders.—These should be graduated to contain their respective volumes at the standard temperature. Their inside diameter must not be more than one-fifth the graduated length.

Transfer Pipettes.—These should be graduated to deliver at standard temperature the exact volume of fluid indicated. The suction stem should be at least 16 cm. long, and the delivery tube not less than 3 cm. nor more than 25 cm. long. The inside diameter at the capacity mark must not be less than 2 mm. and not exceed 4 mm. for those of 25 mil capacity. The capacity mark should not be more than 6 cm. from the bulb. The outlet of any transfer pipette should be of such size that the free outflow shall last not more than 1 minute, nor less than 15 seconds for 5 mils, 20 seconds for 10 mils and 30 seconds for 50 mils. After filling, the fluid adhering to the outside should be wiped from the stem; then when draining the contents, the pipette should be held in a vertical position; finally, to complete the emptying, the tip of the pipette should be held against the side of the vessel, permitting the last portions of the fluid to flow out by gravity. Pipettes should never be drained by blowing into them.

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* 500 mils would weigh 498.02 Gm.; 250 mils, 249.01 Gm.; 100 mils, 99.604 Gm.

Burettes.—These must be provided with glass stop-cocks and be graduated for use at the standard temperature. Burettes provided with rubber tubes and pinch-cocks in place of glass stop-cocks may be used for potassium and sodium hydroxide V.S. The tips should be gradually tapered from 2 to 3 cm. in length and slightly bent. The rate of outflow should be regulated so that not less than two seconds should be consumed for each mil of the length of the column delivered. When completing titration, the tip of the delivery tube should be touched with the wet surface of the receiving vessel to complete the emptying.

General Directions.—All bottles in which volumetric solutions are to be kept, as well as the burettes or pipettes in which they are to be measured, should, prior to use, be thoroughly cleaned and rinsed first with distilled water, and then with two or three small portions of the solution that they are to contain. In all apparatus where the surface of the fluid is limited by a meniscus, the reading must be made from the lowest point of the meniscus unless the liquid is too opaque to permit exact observation of that point. It is of the utmost importance that the inner surface of all measuring apparatus shall be free from any suggestion of greasiness.

Normal volumetric solutions $\frac{N}{1}$ are those which contain in 1000 mils, in any stated reaction, the chemical equivalent of one gramme of hydrogen. If the molecule of the reagent is univalent, one liter will contain a weight in grammes equal to the molecular weight of the reagent; if bivalent, a weight in grammes equal to one-half its molecular weight; if trivalent, a weight in grammes equal to one-third its molecular weight. Thus, hydrochloric acid, $HCl = 36.47$, having but one H atom replaceable by a basic element, has 36.47 Gm. of HCl in 1000 mils of the normal volumetric solution; while sulphuric acid, $H_2SO_4 = 98.09$, having two replaceable H atoms, contains only one-half this number, or 49.045 Gm. of H_2SO_4 in 1000 mils of its normal solution. Potassium hydroxide, $KOH = 56.11$, has but one K to replace one H in acids, hence its normal solution contains 56.11 Gm. of KOH in one liter. Again, one molecule of potassium dichromate ($K_2Cr_2O_7 = 294.20$) in oxidation liberates three atoms of oxygen which are capable of oxidizing six atoms of ferrous to ferric iron. Therefore, each molecule of the dichromate, yielding three atoms of oxygen, is equivalent to six atoms of hydrogen. Hence, the normal solution should contain $\frac{294.20}{6}$ or 49.0333 Gm. in 1000 mils. Two molecules of potassium permanganate, $2KMnO_4 = 316.06$, in oxidation, give off five atoms of O, which are equivalent to ten atoms of H; hence its normal solution should contain $\frac{316.06}{10}$ or 31.606 in 1000 mils. Solutions containing in 1000 mils one-tenth of the quantity of the active reagent in the normal solution are called tenth-normal $\left(\frac{N}{10}\right)$ (normality = 0.1); those containing one hundredth, hundredth-normal $\left(\frac{N}{100}\right)$ (normality = 0.01); those containing one-fiftieth, fiftieth-normal $\left(\frac{N}{50}\right)$ (normality = 0.02); those containing twice the amount, double-normal $\frac{2N}{1}$ (normality = 2); half the amount, half-normal $\frac{N}{2}$ (normality = 0.5). Solutions containing quantities of the active reagent having no simple relation to the molecular weight are called empirical.

Use of Empirical Solutions.—All standard volumetric solutions are liable to deteriorate in time, some very slowly, others rapidly, especially when not properly preserved. To restore the titer of such solutions (that is, to make them exactly normal, tenth-, or hundredth-normal, as the case may be) each time they are to be used, involves an unnecessary waste of time. If one accurately standardized solution be always available, it is not necessary that the other volumetric solutions employed in conjunction with it be adjusted to exactly correspond, mil for mil, so long as the *exact* ratio is known at standard temperature. The percentage strength of any empirical solution as compared with a standard volumetric solution is ascertained by experiment, then the number of mils of the empirical solution consumed in the titration of the substance is multiplied by its percentage strength, which product represents the equivalent volume of the true standard solution.

Example: One gramme of potassium carbonate required for neutralization 22 mils of an empirical solution of hydrochloric acid. In a trial experiment, 16 mils of this weak solution was required to neutralize 10 mils of a standard normal potassium hydroxide V.S. The former was therefore of 62.5 per cent. strength (for $16 : 10 : : 100 : x.\quad x = 62.5$), hence the 22 mils of empirical solution consumed represents 13.75 mils (62.5 per cent. of 22) of standard normal hydrochloric acid V.S. Therefore since 1 mil of $\frac{N}{1}$ hydrochloric acid V.S. = 0.0691 Gm. of K_2CO_3, 13.75 mils would be equivalent to 13.75 × 0.0691 or 0.9501 + Gm. of potassium carbonate.

Adjustment of titer of volumetric solutions which are above strength. Titrate 25 mils of the strong solution, with a carefully standardized corresponding solution, which must be of the same standard temperature. The number of mils of the latter consumed, divided by 25, will give the factor to be employed in adjusting the strength of the former.

Example: 25 mils of a "strong" normal solution of hydrochloric acid required 27.25 mils of standard normal potassium hydroxide V.S. for neutralization. The correcting factor is therefore 27.25 ÷ 25 = 1.09. If the "strong" solution measures 875 mils its volume must be made up with distilled water to 875 × 1.09 = 953.75 mils. Add therefore to the "strong" solution 953.75 — 875 = 78.75 mils of distilled water. After the solution is thus diluted, its titer should be verified by the titration of 25 mils with the standard normal potassium hydroxide V.S., the measurements in each case being made at 25° C. (or at least at the same temperature). It should require exactly 25 mils of the latter for neutralization. If this is not the case, either a new adjustment must be made, or else the new correction factor must be plainly written on the label of the bottle, and the required correction made whenever the solution is used.

Alkaline Cupric Tartrate Volumetric Solution

FEHLING'S SOLUTION

A. The Copper Solution.—Dissolve 34.66 Gm. of carefully selected, small crystals of cupric sulphate (*Cupri Sulphas,* U. S. P.), showing no trace of efflorescence or of adhering moisture, in a sufficient quantity of distilled water to make the solution measure exactly 500 mils at standard temperature. Keep this solution in small, well-stoppered bottles.

B. The Alkaline Tartrate Solution.—Dissolve 173 Gm. of crystallized potassium and sodium tartrate (*Potassii et Sodii Tartras,* U. S. P.) and 50 Gm. of sodium hydroxide (*Sodii Hydroxidum,* U. S. P.) in a sufficient quantity of distilled water to make the solution measure exactly 500 mils at standard temperature. Keep the solution in small, rubber-stoppered bottles. For use, mix exactly equal volumes of the two solutions at the time required.*

One Mil of the Mixed Solution is the equivalent of:

	Gramme
Cupric Sulphate, crystallized, $CuSO_4 + 5H_2O$	0.03466
Cupric Tartrate, $CuC_4H_4O_6 + 3H_2O$	0.03688
Cane Sugar $C_{12}H_{22}O_{11}$ (after inversion)	0.00475
Glucose, anhydrous, $C_6H_{12}O_6$	0.00500
Milk Sugar, anhydrous, $C_{12}H_{22}O_{11}$	0.00678

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* The accuracy of this solution when employed in titration may be verified as follows: To a solution of 0.95 Gm. of pure cane sugar in about 50 mils of distilled water, add 2 mils of hydrochloric acid and heat at 70° C. for ten minutes. After neutralizing with sodium carbonate, dilute the solution to 1000 mils. Fifty mils of this dilution should reduce the copper in exactly 10 mils of the solution.

Tenth-Normal Barium Hydroxide Volumetric Solution

$Ba(OH)_2 + 8H_2O = 315.51$ 15.776 Gm. in 1000 mils

Dissolve about 18 Gm. of crystallized barium hydroxide in 1000 mils of recently boiled and cooled distilled water and, if necessary, filter the solution quickly.

Introduce 25 mils of tenth-normal sulphuric acid V.S. or preferably tenth-normal hydrochloric acid V.S. into a flask, add 3 drops of phenolphthalein T.S., and run in the barium hydroxide solution from a burette, provided with a soda-lime tube, reducing the flow to drops towards the end, until a pale pink color is produced which no longer disappears on shaking the liquid for about ten seconds. Note the number of mils of the barium hydroxide solution consumed, and if the solution is too concentrated dilute the remainder of the solution with freshly boiled and cooled distilled water, so that equal volumes of the barium hydroxide solution and of tenth-normal sulphuric or hydrochloric acid at 25° C. exactly neutralize each other.

Note: This solution absorbs carbon dioxide from the air very rapidly, thereby changing its titer. It should, therefore, be preserved in rubber-stoppered bottles provided with a soda-lime tube (see under normal potassium hydroxide V.S.). This solution must also be standardized each time before using.

One Mil of Tenth-Normal Barium Hydroxide V.S. is the equivalent of:

	Gramme
Barium Hydroxide, $Ba(OH)_2 + 8H_2O$	0.015776
Ammonium Benzoate, $NH_4C_7H_5O_2$	0.013908
Ammonium Salicylate, $NH_4C_7H_5O_3$	0.015508
Benzoic Acid, $C_7H_6O_2$	0.012205
Hydrochloric Acid, HCl	0.003647
Salicylic Acid, $C_7H_6O_3$	0.013805
Sulphuric Acid, H_2SO_4	0.0049045

Tenth=Normal Bromine Volumetric Solution

[Koppeschaar's Solution]

Br = 79.92 7.992 Gm. in 1000 mils

Dissolve 3 Gm. of potassium bromate (see page 1508) and 50 Gm. of potassium bromide in sufficient distilled water to measure 1000 mils at or near 25° C. Transfer 20 mils of this solution at standard temperature, by means of a pipette, to a bottle having a capacity of about 250 mils, and provided with a glass stopper; add 75 mils of distilled water and 5 mils of hydrochloric acid (see page 659) and immediately insert the stopper. Shake the bottle a few times, then remove the stopper just sufficiently to quickly introduce 5 mils of potassium iodide T.S., taking care that no bromine vapors escape, and immediately stopper the bottle. Agitate the bottle thoroughly, remove the stopper and rinse it and the neck of the bottle with a little distilled water so that the washings flow into the bottle, and then add from a burette tenth-normal sodium thiosulphate V.S. until the solution is only slightly yellow, then add a few drops of starch T.S. and continue the addition of tenth-normal sodium thiosulphate V.S. until the blue color is just discharged. Note the number of mils of the sodium thiosulphate V.S. thus consumed, and then dilute the bromine solution so that equal volumes of it and of tenth-normal sodium thiosulphate V.S. will exactly correspond to each other under the conditions mentioned above. Keep the solution in dark amber-colored, glass-stoppered bottles.

Example: Assuming that the 20 mils of the bromine solution have required 22.5 mils of the sodium thiosulphate V.S. to completely discharge the iodine tint, then each 20 mils of the bromine solution must be diluted to 22.5 mils. Thus, if 960 mils of the solution remain, it must be diluted with distilled water to measure 1080 mils. After the solution is thus diluted, a new trial should be made in the manner above described, in which 25 mils of the tenth-normal sodium thiosulphate V.S. should just discharge the tint of the iodine liberated by the bromine set free from 25 mils of the standard bromine solution.

One Mil of Tenth-Normal Bromine V.S. is the equivalent of:

	Gramme
Bromine, Br.	0.007992
Orcin, $C_7H_6(OH)_2$	0.002068
Phenol, C_6H_5OH	0.001568
Resorcinol, $C_6H_4(OH)_2$	0.001834
Sodium Phenolsulphonate, anhydrous, $NaC_6H_5O_4S$	0.004903
Sodium Phenolsulphonate, crystallized, $NaC_6H_5O_4S + 2H_2O$	0.0058035

Normal Hydrochloric Acid Volumetric Solution

HCl = 36.47 36.47 Gm. in 1000 mils

Mix 110 mils of hydrochloric acid (*Acidum Hydrochloricum*, U. S. P.) with sufficient distilled water to measure 1000 mils. Of this liquid (which is still too concentrated) carefully measure, at standard temperature from a burette, 25 mils into a flask or porcelain dish, and after diluting with about double its volume of distilled water add 2 drops of methyl orange T.S., then gradually add from a burette a freshly standardized normal potassium hydroxide V.S., at the same temperature, until the red or pink tint of the solution changes, after continuous shaking or stirring, to a permanent pale yellow. Note the number of mils of potassium hydroxide V.S. consumed, and then dilute the acid solution so that equal volumes of this and of the normal potassium hydroxide V.S. neutralize each other at 25° C.

Example: Assuming that 25 mils of the acid solution first prepared required exactly 27.5 mils of normal potassium hydroxide V.S., each 25 mils of the former must be diluted to 27.5 mils or the whole of the remaining acid solution in the same proportion at standard temperature. Thus, if 950 mils should remain, 95 mils of distilled water must be added. After the liquid is thus diluted, a new trial should be made in the manner above described, in which 25 mils of the acid solution should require for neutralization exactly 25 mils of normal potassium hydroxide V.S. If necessary, a new adjustment should then be made to render the correspondence perfect at standard temperature.

Alternative Method.—Normal hydrochloric acid V.S. may be standardized as directed under normal sulphuric acid V.S., employing the alternative method.

One Mil of Normal Hydrochloric Acid V.S. is the equivalent of:

	Gramme
Hydrochloric Acid, HCl	0.03647
Barium Hydroxide, $Ba(OH)_2 + 8H_2O$	0.15776
Calcium Carbonate, $CaCO_3$	0.050035
Calcium Hydroxide, $Ca(OH)_2$	0.037045
Calcium Oxide, CaO	0.028035
Potassium Hydroxide, KOH	0.05611
Sodium Borate, anhydrous, $Na_2B_4O_7$	0.1010
Sodium Borate, crystallized, $Na_2B_4O_7 + 10H_2O$	0.19108
Sodium Cacodylate, anhydrous, $Na(CH_3)_2.AsO_2$	0.1600
Sodium Hydroxide, NaOH	0.04001

Note: Normal hydrochloric acid is in every respect equivalent in neutralizing power to normal sulphuric acid (see page 1533), and may be employed, except in special cases, for the same purposes.

Half-Normal Hydrochloric Acid Volumetric Solution

HCl = 36.47 18.235 Gm. in 1000 mils

Dilute 500 mils of normal hydrochloric acid V.S. at 25° C. with sufficient distilled water to measure at the same temperature exactly 1000 mils.

One Mil of Half-Normal Hydrochloric Acid V.S. is the equivalent of:

	Gramme
Hydrochloric Acid, HCl	0.018235
Benzaldehyde, C_7H_6O	0.0530
Calcium Lactate, $Ca(C_3H_5O_3)_2$, anhydrous	0.05454

	Gramme
Cinnamic Aldehyde, C_9H_8O	0.033015
Citral, $C_{10}H_{16}O$	0.076
Lithium Salicylate, $LiC_7H_5O_3$	0.07199
Magnesium Hydroxide, $Mg(OH)_2$	0.0148
Potassium Acetate, $KC_2H_3O_2$	0.04906
Potassium Bicarbonate, $KHCO_3$	0.050055
Potassium Bitartrate, $KHC_4H_4O_6$	0.09407
Potassium Carbonate, anhydrous, K_2CO_3	0.03455
Potassium Citrate, anhydrous, $K_3C_6H_5O_7$	0.051057
Potassium Citrate, crystallized, $K_3C_6H_5O_7 + H_2O$	0.05406
Potassium Hydroxide, KOH	0.028055
Potassium and Sodium Tartrate, anhydrous, $KNaC_4H_4O_6$	0.052533
Potassium and Sodium Tartrate, crystallized, $KNaC_4H_4O_6 + 4H_2O$	0.07055
Sodium Acetate, anhydrous, $NaC_2H_3O_2$	0.04101
Sodium Acetate, crystallized, $NaC_2H_3O_2 + 3H_2O$	0.068035
Sodium Benzoate, $NaC_7H_5O_2$	0.07202
Sodium Bicarbonate, $NaHCO_3$	0.042005
Sodium Carbonate, anhydrous, Na_2CO_3	0.026500
Sodium Carbonate, monohydrated, $Na_2CO_3 + H_2O$	0.031005
Sodium Citrate, anhydrous, $Na_3C_6H_5O_7$	0.04301
Sodium Citrate, crystallized, $Na_3C_6H_5O_7 + 2H_2O$	0.04901
Sodium Glycerophosphate, $Na_2C_3H_7PO_6$	0.10805
Sodium Hydroxide NaOH	0.020005
Sodium Salicylate, $NaC_7H_5O_3$	0.08002
Sodium Tartrate, neutral, $Na_2C_4H_4O_6 + 2H_2O$	0.057515
Strontium Salicylate, anhydrous, $Sr(C_7H_5O_3)_2$	0.09043
Strontium Salicylate, crystallized, $Sr(C_7H_5O_3)_2 + 2H_2O$	0.099435

Tenth-Normal Iodine Volumetric Solution

I = 126.92 12.692 Gm. in 1000 mils

Tenth-normal iodine V.S. may be prepared according to either of the following methods:

I. Dissolve 12.692 Gm. of purified iodine (see page 1501) in a solution of 18 Gm. of potassium iodide in 300 mils of distilled water. Then add sufficient distilled water to make the solution measure exactly 1000 mils at standard temperature. Transfer the solution to glass-stoppered bottles. Unless freshly prepared, its strength should always be determined anew at the time it is used.

II. Tenth-normal iodine V.S. may also be prepared as follows:

Dissolve about 14 Gm. of iodine (*Iodum*, U. S. P.) in a solution of 18 Gm. of potassium iodide (*Potassii Iodidum*, U. S. P.) in about 300 mils of distilled water, diluting finally to 1000 mils. Carefully measure from a burette 25 mils of this solution (which is too concentrated), into a flask, then add gradually and cautiously from a burette tenth-normal sodium thiosulphate V.S. (shaking constantly), until the color of the solution is but slightly yellow, then add a few drops of starch T.S. and continue the addition of the tenth-normal sodium thiosulphate V.S. until the blue color is just discharged. Note the number of mils of the sodium thiosulphate V.S. consumed, and then dilute the iodine solution so that 25 mils will require for decolorization exactly 25 mils of the tenth-normal sodium thiosulphate V.S. at standard temperature.

One Mil of Tenth-Normal Iodine V.S. is the equivalent of:

	Gramme
Iodine, I	0.012692
Acetone, $(CH_3)_2CO$	0.0009675
Antimony and Potassium Tartrate, crystallized, $K(SbO)C_4H_4O_6 + \frac{1}{2}H_2O$	0.016617
Arsenic, in arsenous compounds, As	0.003748
Arsenic Iodide, AsI_3	0.022786
Arsenic Trioxide (Arsenous Acid), As_2O_3	0.004948
Calcium Sulphide, crude, CaS	0.003607

	Gramme
Iron, Fe	0.002792
Mercurous Chloride, HgCl	0.023606
Mercurous Iodide, HgI	0.032752
Mercury (in mercurous compounds), Hg	0.02006
Potassium Sulphite, crystallized, $K_2SO_3 + 2H_2O$	0.009715
Sodium Bisulphite, $NaHSO_3$	0.005204
Sodium Sulphite, anhydrous, Na_2SO_3	0.006304
Sodium Thiosulphate, anhydrous, $Na_2S_2O_3$	0.015814
Sodium Thiosulphate, crystallized, $Na_2S_2O_3 + 5H_2O$	0.024822
Sulphur Dioxide, SO_2	0.0032035

Tenth-Normal Oxalic Acid Volumetric Solution

$H_2C_2O_4 + 2H_2O = 126.05$ 6.3025 Gm. in 1000 mils

Dissolve 6.45 Gm. of purified oxalic acid (see page 1506) in sufficient distilled water to measure 1000 mils. Into a flask accurately measure from a burette 25 mils of a freshly standardized tenth-normal potassium hydroxide V.S., dilute with about 20 mils of distilled water, add 3 to 5 drops of phenolphthalein T.S. and heat it to boiling. From a burette gradually add the oxalic acid solution (which is still too concentrated) until the red tint of the alkali solution fails to reappear after vigorous shaking and boiling. Note the number of mils of the oxalic acid solution consumed, and then dilute it so that equal volumes of this and of the tenth-normal potassium hydroxide V.S. neutralize each other at standard temperature. This volumetric solution deteriorates on standing, hence must be frequently renewed or restandardized.

NOTE: Tenth-normal oxalic acid V.S. is in every respect equivalent in neutralizing power to any other tenth-normal acid V.S. with either litmus or phenolphthalein T.S. as indicator. Its specific use, however, is in standardizing or determining an excess of tenth-normal potassium permanganate V.S.

One Mil of Tenth-Normal Oxalic Acid V.S. is the equivalent of:

	Gramme
Oxalic Acid, crystallized, $H_2C_2O_4 + 2H_2O$	0.0063025
Ammonia Gas, NH_3	0.0017034
Calcium Carbonate, $CaCO_3$	0.0050035
Calcium Hydroxide, $Ca(OH)_2$	0.0037045
Calcium Oxide, CaO	0.0028035
Lead, Pb	0.010355
Lead Acetate, $Pb(C_2H_3O_2)_2$	0.016257
Lead Oxide, PbO	0.011155
Lead Peroxide, PbO_2	0.011955
Lead Subacetate, $Pb_2O(C_2H_3O_2)_2$	0.013706
Manganese Dioxide, MnO_2	0.0043465
Potassium Hydroxide, KOH	0.005611
Potassium Permanganate, $KMnO_4$	0.0031606
Sodium Hydroxide, NaOH	0.004001

Tenth-Normal Potassium Dichromate Volumetric Solution

$K_2Cr_2O_7 = 294.20$ 4.9033 Gm. in 1000 mils

Dissolve 4.9033 Gm. of purified potassium dichromate (see page 1508), which has been pulverized and dried to constant weight at 120° C., in sufficient distilled water to measure exactly 1000 mils at standard temperature. When used as an oxidizing agent in titration to convert ferrous into ferric salts, or to liberate iodine from potassium iodide, the solution just mentioned (containing 14.710 Gm. in 1000 mils) has the effect of a $\frac{3N}{10}$ volumetric solution, and a solution of one-third of this strength, containing 4.9033 Gm. in 1000 mils, has the value of a tenth-normal solution, and is the equivalent of an equal volume of tenth-normal potassium permanganate V.S., or, in the case of iodine liberated from potassium iodide, it is the equivalent of an equal volume of tenth-normal sodium thiosulphate V.S. For titrating iron in ferrous compounds, it is used in the following manner. Introduce the aqueous solution of the ferrous salt into a flask and, if it is not already acid, render it so with sulphuric acid. Now add gradually tenth-normal potassium dichromate V.S. from a burette with agitation until a drop taken out upon a white surface no longer becomes blue when mixed with a drop of freshly prepared potassium ferricyanide T.S. Tenth-normal potassium dichromate V.S. may also be used in conjunction with potassium iodide (from which it liberates iodine) and sulphuric acid, for adjusting the titer of sodium thiosulphate V.S., and thus that of the iodine V.S.

One Mil of Tenth-Normal Potassium Dichromate V.S. is the equivalent of:

	Gramme
Potassium Dichromate, $K_2Cr_2O_7$	0.0049033
Ferrous Carbonate, $FeCO_3$	0.011584
Ferrous Sulphate, anhydrous, $FeSO_4$	0.015191
Ferrous Sulphate, crystallized, $FeSO_4 + 7H_2O$	0.027802
Iron, in ferrous compounds, Fe	0.005584
Sodium Thiosulphate, $Na_2S_2O_3 + 5H_2O$	0.024822

Normal Potassium Hydroxide Volumetric Solution

KOH = 56.11 56.11 Gm. in 1000 mils

Dissolve 75 Gm. of the official potassium hydroxide in sufficient recently boiled distilled water to measure about 1050 mils and fill a burette with a portion of this liquid. Into a flask of the capacity of about 300 mils, introduce 4.7035 Gm. of potassium bitartrate (which has been purified and dried as directed on page 1507) followed by 15 mils (accurately measured at 25° C.) of the potassium hydroxide solution which is being prepared and 80 mils of distilled water. Heat the solution to boiling, add from 3 to 5 drops of phenolphthalein T.S. and then cautiously, at standard temperature from a burette, further portions of the potassium hydroxide solution. Agitate the flask frequently, boil the liquid toward the end of the operation and reduce the flow of potassium hydroxide solution to drops, until the red color produced by its influx no longer disappears on shaking, and the liquid is not deeper in color than a pale pink. Note the total number of mils of the potassium hydroxide solution consumed, and then dilute the remainder of the solution so that exactly 25 mils of the diluted liquid, at standard temperature, shall be required to neutralize 4.7035 Gm. of the purified and dried potassium bitartrate.

EXAMPLE: Assuming that 20 mils of the stronger solution of potassium hydroxide first prepared had been consumed in the trial, then each 20 mils must be diluted to 25 mils or the whole of the remaining solution in the same proportion at standard temperature. Thus, if 1000 mils should be still remaining, this must be diluted with water to 1250 mils. After the liquid is thus diluted, a new trial should be made in the manner above described, in which 25 mils of the diluted solution should exactly neutralize 4.7035 Gm. of potassium bitartrate at standard temperature. If necessary, new adjustments should then be made to render the correspondence perfect.

ALTERNATIVE METHOD.—Normal potassium or sodium hydroxide V.S. may be standardized against normal sulphuric acid V.S. which has been standardized by its alternative method, employing the trial solution directed in the first paragraph. Measure accurately 25 mils of this solution, at standard temperature, from a burette into a flask, add 2 drops of methyl orange T.S. or methyl red T.S., and afterwards from a burette the standard normal sulphuric acid V.S. at the same temperature, shaking after each addition, and, toward the end of the operation, reducing the flow to drops, until the yellow tint of the solution changes to a permanent rose after shaking. Note the number of mils of normal sulphuric acid V.S. consumed. Then dilute the potassium hydroxide solution so that 25 mils of this and 25 mils of the normal sulphuric acid V.S., at standard temperature, exactly neutralize each other.

NOTE: Solutions of caustic alkalies absorb carbon dioxide from the atmosphere, and thereby change their titer when used with litmus T.S., or phenolphthalein T.S. (in cold solution), as indicator (methyl orange T.S. is not affected by the presence of carbonic acid). Hence the volumetric solutions should be preserved in bottles provided with well-fitting rubber stoppers, or, better still, these should be provided with the tubes filled with soda-lime (a mixture of caustic soda and lime); the tubes pass through a perforation in the rubber stoppers and thus absorb the carbon dioxide and prevent its access to the solution. If the solution is kept in a burette for more than a few minutes, the same provision with a soda-lime tube should be observed. In place of potassium hydroxide V.S., sodium hydroxide V.S. may be used, in the same manner and in the same quantity.

One Mil of Normal Potassium Hydroxide V.S. is the equivalent of:

	Gramme
Potassium Hydroxide, KOH	0.05611
Acetic Acid, $HC_2H_3O_2$	0.06003
Acetic Acid Anhydride, $(CH_3CO)_2O$	0.05102
Ammonia Gas, NH_3	0.01703
Ammonium Chloride, NH_4Cl	0.05350
Boric Acid, H_3BO_3	0.06202
Citric Acid, crystallized, $H_3C_6H_5O_7 + H_2O$	0.07003
Formaldehyde, CH_2O	0.03002
Hydrated Chloral, $C_2HOCl_3 + H_2O$	0.1654
Hydriodic Acid, HI	0.12793
Hydrobromic Acid, HBr	0.08093
Hydrochloric Acid, HCl	0.03647
Hypophosphorous Acid, HPH_2O_2	0.06606
Lactic Acid, $HC_3H_5O_3$	0.09005
Nitric Acid, HNO_3	0.06302
Oxalic Acid, crystallized, $H_2C_2O_4 + 2H_2O$	0.063025
Paraformaldehyde, $(CH_2O)_3$	0.03002
Phosphoric Acid, H_3PO_4 (to form K_2HPO_4; with phenolphthalein)	0.04903
Potassium Bitartrate, $KHC_4H_4O_6$	0.18814
Sodium Bitartrate, $NaHC_4H_4O_6 + H_2O$	0.19006
Sodium Hydroxide, $NaOH$	0.04001
Sulphuric Acid, H_2SO_4	0.049045
Sulphuric Anhydride, SO_3	0.040035
Tartaric Acid, $H_2C_4H_4O_6$	0.07503
Trichloracetic Acid, $HC_2O_2Cl_3$	0.16339

Half-Normal Potassium Hydroxide Volumetric Solution

$KOH = 56.11$ 28.055 Gm. in 1000 mils

Dilute 500 mils of freshly standardized normal potassium hydroxide V.S., at standard temperature, with sufficient recently boiled distilled water at the same temperature to measure exactly 1000 mils. This solution may also be prepared and standardized directly with potassium bitartrate, as directed under normal potassium hydroxide V.S., employing for this purpose 2.3518 Gm. of the former and a solution of about 35 Gm. of potassium hydroxide (*Potassii Hydroxidum*, U. S. P.) in 1000 mils of distilled water. Twenty-five mils of half-normal solution, at standard temperature, should exactly neutralize 2.3518 Gm. of potassium bitartrate (see page 1507). This solution may also be standardized by comparison with half-normal sulphuric acid V.S., employing methyl-orange T.S. as indicator.

NOTE: The same precautions should be taken for protecting this solution from carbon dioxide of the air as are directed under normal potassium hydroxide V.S.

One Mil of Half-Normal Potassium Hydroxide V.S. is the equivalent of:

	Gramme
Potassium Hydroxide, KOH	0.02806
Acetic Acid, $HC_2H_3O_2$	0.03002
Boric Acid, H_3BO_3	0.03101
Citric Acid, crystallized, $H_3C_6H_5O_7 + H_2O$	0.03502
Hydriodic Acid, HI	0.06397
Hydrobromic Acid, HBr	0.04047
Hydrochloric Acid, HCl	0.01824
Hypophosphorous Acid, HPH_2O_2	0.03303
Lactic Acid, $HC_3H_5O_3$	0.04503

	Gramme
Nitric Acid, HNO_3	0.03151
Oxalic Acid, crystallized, $H_2C_2O_4 + 2H_2O$	0.03153
Phosphoric Acid, H_3PO_4 (to form K_2HPO_4, with phenolphthalein)	0.02452
Potassium Bitartrate, $KHC_4H_4O_6$	0.09407
Sodium Bitartrate, $NaHC_4H_4O_6 + H_2O$	0.09503
Sodium Hydroxide, NaOH	0.020005
Sulphuric Acid, H_2SO_4	0.024523
Sulphuric Anhydride, SO_3	0.02002
Tartaric Acid, crystallized, $H_2C_4H_4O_6$	0.03751
Trichloracetic Acid, $HC_2O_2Cl_3$	0.08170

Tenth-Normal Potassium Hydroxide Volumetric Solution

KOH = 56.11 5.611 Gm. in 1000 mils

Dilute 100 mils of freshly standardized normal potassium hydroxide V.S., at standard temperature, with sufficient recently boiled distilled water at the same temperature to measure exactly 1000 mils. This solution may also be prepared and standardized directly with potassium bitartrate, as directed under normal potassium hydroxide V.S., employing for this purpose 0.9407 Gm. of the bitartrate and a solution of about 7.5 Gm. of potassium hydroxide (*Potassii Hydroxidum*, U. S. P.) in 1000 mils of distilled water. Fifty mils of tenth-normal solution, at standard temperature, should exactly neutralize 0.9407 Gm. of potassium bitartrate (see page 1507). This solution may also be standardized by comparison with tenth-normal sulphuric acid V.S., employing methyl orange T.S. as indicator.

NOTE: The same precautions should be taken for protecting this solution from carbon dioxide of the air as are directed under normal potassium hydroxide V.S.

One Mil of Tenth-Normal Potassium Hydroxide V.S. is the equivalent of:

	Gramme
Potassium Hydroxide, KOH	0.005611
Betaeucaine Hydrochloride, $C_{15}H_{21}O_2N.HCl$	0.028365
Lactic Acid, $HC_3H_5O_3$	0.009005
Potassium Bitartrate, $KHC_4H_4O_6$	0.018814
Sulphuric Acid, H_2SO_4	0.0049045

Fiftieth-Normal Potassium Hydroxide Volumetric Solution

KOH = 56.11 1.1222 Gm. in 1000 mils

Dilute 20 mils of a freshly standardized normal or preferably 200 mils of tenth-normal potassium hydroxide V.S. at standard temperature, with sufficient recently boiled distilled water at the same temperature to measure exactly 1000 mils. Verify the titer of this solution by titrating 0.1881 Gm. of potassium bitartrate (see page 1507) which should require for neutralization exactly 50 mils of the volumetric solution. This standard solution is employed in conjunction with the tenth-normal sulphuric acid V.S. in the titration of alkaloids, with hematoxylin, cochineal, methyl red, or iodeosin T.S. as indicators. The relative value of these two volumetric solutions should be determined each time, using the indicator employed in the alkaloidal assay.

NOTE: The same precautions should be taken for protecting this solution from carbon dioxide of the air as are directed under normal potassium hydroxide V.S. It should be renewed at frequent intervals.

One Mil of Fiftieth-Normal Potassium Hydroxide V.S. is the equivalent of:

	Gramme
Potassium Hydroxide, KOH	0.0011222
Potassium Bitartrate, $KHC_4H_4O_6$	0.0037628
Sulphuric Acid, H_2SO_4	0.0009809

Hundredth-Normal Potassium Hydroxide Volumetric Solution

KOH = 56.11 0.5611 Gm. in 1000 mils

Dilute 10 mils of normal or preferably 100 mils of tenth-normal potassium hydroxide V.S., at standard temperature, with sufficient recently boiled distilled water at the same temperature to measure exactly 1000 mils. Verify the titer of this solution by titrating 0.0941 Gm. of potassium bitartrate (see page 1507), which should require for neutralization exactly 50 mils of the volumetric solution at standard temperature. This solution must be frequently renewed.

One Mil of Hundredth-Normal Potassium Hydroxide V.S. is the Equivalent of:

	Gramme
Potassium Hydroxide, KOH	0.0005611
Potassium Bitartrate, $KHC_4H_4O_6$	0.0018814
Sulphuric Acid, H_2SO_4	0.00049045

Half-Normal Alcoholic Potassium Hydroxide Volumetric Solution

KOH = 56.11 28.055 Gm. in 1000 mils

Dissolve from 2 to 3 Gm. of silver nitrate in 5 mils of distilled water and add the solution to 1200 mils of alcohol (*Alcohol,* U. S. P.) in a glass-stoppered bottle, and mix thoroughly. Dissolve about 5 Gm. of official potassium hydroxide in 25 mils of warm alcohol, cool the solution, and pour it slowly, without stirring, into the alcoholic solution of silver nitrate. Let the mixture stand until the precipitated silver oxide has settled, filter and distil. Dissolve about 35 Gm. of official potassium hydroxide in 20 mils of distilled water and add sufficient alcohol, purified as directed above, to measure 1000 mils. Let the solution stand in a glass-stoppered or rubber-stoppered bottle for one day, then quickly decant the clear, supernatant solution into a bottle provided with a well-fitted rubber stopper. Into a flask of the capacity of about 300 mils introduce 2.3518 Gm. of potassium bitartrate, which has been purified and dried, as directed on page 1507, and about 100 mils of distilled water. Heat the solution to the boiling point, add about 5 drops of phenolphthalein T.S., then run in cautiously at standard temperature from a burette the potassium hydroxide solution prepared as above, keeping the liquid hot and frequently agitating the flask, and, toward the end of the operation, reducing the flow to drops until the red color produced by its influx no longer disappears on shaking, and the liquid is not deeper than pale pink. Note the number of mils of the alcoholic potassium hydroxide solution consumed, and then dilute the remainder of the solution with alcohol purified as directed above, so that exactly 25 mils of the diluted liquid, at standard temperature, shall be required to neutralize 2.3518 Gm. of potassium bitartrate.

Half-normal alcoholic potassium hydroxide V.S. may also be standardized as follows: Of the above described concentrated alcoholic potassium hydroxide solution, carefully measure, at standard temperature, from a burette 30 mils into a flask, and, after diluting with about 50 mils of distilled water, add about 5 drops of phenolphthalein T.S., heat to boiling temperature, and add from a burette half-normal hydrochloric acid V.S., at standard temperature, frequently agitating the flask, and, toward the end of the operation, reducing the flow to drops until the red color of the liquid is just discharged. Note the number of mils of the half-normal hydrochloric acid V.S. consumed, and then dilute the remainder of the solution with the purified alcohol so that 25 mils of this and 25 mils of half-normal hydrochloric acid V.S., at standard temperature, neutralize each other. Should half-normal hydrochloric acid V.S. not be available, standardization can be carried out in the same manner with normal hydrochloric acid V.S., two volumes of the alcoholic potassium hydroxide being made to correspond with one volume of the normal acid.

NOTE: This solution should be kept in bottles provided with well-fitted rubber stoppers and protected from the light. Owing to the readiness with which this standard solution loses its titer blank tests should be performed whenever it is employed in titrations. It is important that this volumetric solution be standardized at the temperature at which it is used.

One Mil of Half-Normal Alcoholic Potassium Hydroxide V.S. is the Equivalent of:

	Gramme
Potassium Hydroxide, KOH	0.028055
Borneol, $C_{10}H_{18}O$	0.07707
Bornyl Acetate, $C_{10}H_{17}.C_2H_3O_2$	0.09808
Menthol, $C_{10}H_{20}O$	0.07808
Menthyl Acetate, $C_{10}H_{19}.C_2H_3O_2$	0.09909
Methyl Salicylate, $CH_3.C_7H_5O_3$	0.07603
Potassium Bitartrate, $KHC_4H_4O_6$	0.09407
Santalol, $C_{15}H_{26}O$	0.111105

Tenth-Normal Potassium Permanganate Volumetric Solution

$KMnO_4 = 158.03$ 3.1606 Gm. in 1000 mils

Introduce about 3.3 Gm. of crystallized potassium permanganate (*Potassii Permanganas*, U. S. P.) into a flask, add 1000 mils of distilled water, and boil for about five minutes. Close the flask with a plug of purified absorbent cotton, and set it aside for at least two days, so that suspended matter may deposit. After the lapse of this time, pour off the clear portion of the solution into a glass-stoppered bottle. The water to be employed for diluting this solution (which is still too concentrated) should be prepared as directed under distilled water (*Aqua Destillata*, U. S. P.), adding, however, about 1 Gm. of potassium permanganate to each liter of water in the retort before beginning the distillation.

The solution may be standardized as follows:

I. Introduce about 0.3 Gm. of sodium oxalate (see page 1512), previously dried to constant weight at 110° C. and accurately weighed, into a beaker of about 400 mils capacity. Dissolve the salt in 250 mils of distilled water, heated to 85° C., and add 5 mils of concentrated sulphuric acid (see page 1515) diluted with an equal volume of distilled water. To this solution, kept at 85° C., add, from a burette, the permanganate solution to be standardized, stirring vigorously and continually with a thermometer, the solution being added not faster than at the rate of from 10 to 15 mils per minute. The last 0.5 to 1 mil of the solution required must be added, drop by drop, with particular care to see that each drop is fully decolorized before introducing the next. When the solution has assumed a faintly pink tint (remaining permanent for thirty seconds), the titration should cease. The excess of permanganate solution required to cause an end-point color must be estimated by matching the color of the liquid being tested with a measured quantity of the same permanganate solution in another beaker containing the same volumes of hot distilled water and sulphuric acid. Note the number of mils of the permanganate solution consumed in the trial titration and deduct from this volume the amount of permanganate solution required to produce the same tint in the water and acid mixture; the difference represents the number of mils of the permanganate solution required to reach the exact end-point in the trial titration.

Each 0.0067 Gm. of sodium oxalate is equivalent to 1 mil of tenth-normal potassium permanganate V.S. The number of grammes of sodium oxalate taken, when multiplied by 149.2537, indicates the number of mils of tenth-normal potassium permanganate V.S. required. The solution may now be adjusted to exactly tenth-normal strength or the factor may be determined and the solution employed empirically. In the former instance note the number of mils of the trial permanganate solution consumed, then dilute it so that the volume of diluted solution corresponds to that obtained by calculation from the sodium oxalate taken.

Example: Assuming that 0.25 Gm. of sodium oxalate was taken, and 35.2 mils of the trial potassium permanganate solution was consumed. Then $0.25 \times 149.2537 = 37.313$, and therefore 35.2 mils (or 352 mils) of the trial potassium permanganate solution are diluted to 37.3 mils (or 373.13 mils). The factor of this trial solution for use as an empirical solution may be determined by dividing the number of mils of the trial permanganate solution consumed, by the number of mils representing the true equivalent volume (product of 149.2537 × the grammes of sodium oxalate used). $37.313 \div 35.2 = 106.00$, which is the percentage strength of the solution based upon the true tenth-normal V.S.

II. Tenth-normal potassium permanganate V.S. may also be standardized as follows:

To a solution of about 1 Gm. of potassium iodide (*Potassii Iodidum*, U. S. P.) in 10 mils of diluted sulphuric acid contained in a flask, slowly add from a burette 25 mils of the potassium permanganate solution to be standardized; mix well, then dilute the mixture at once with about 200 mils of distilled water. Add slowly an accurately standardized tenth-normal sodium thiosulphate V.S. from a burette, shaking the mixture vigorously, until the liquid is but slightly yellow, then add a few drops of starch T.S. and continue the addition of the tenth-normal sodium thiosulphate V.S. until the blue color is just discharged. Note the number of mils of the latter consumed, then dilute the permanganate solution so that 25 mils of the solution corresponds to 25 mils of the tenth-normal sodium thiosulphate V.S. under the same conditions at standard temperature. At least three careful titrations should be made, accepting the average, before diluting.

Example: Assuming that 25 mils of the tenth-normal sodium thiosulphate V.S. was required to decolorize the iodine liberated by 20 mils of the permanganate solution, then each 20 mils of the potassium permanganate solution remaining must be diluted with the specially prepared distilled water to 25 mils, or the whole of the remaining solution in the same proportion. Thus, if 920 mils remain, it should be diluted, at standard temperature, to measure 1150 mils. After the potassium permanganate solution is thus diluted, a new trial should be made in the manner above described, in which 25 mils of this solution should require exactly 25 mils of the tenth-normal sodium thiosulphate V.S. to decolorize the mixture.

Note: When potassium permanganate V.S. is to be prepared for immediate use, this may be done as follows: Dissolve about 3.3 Gm. of crystallized potassium permanganate in 1000 mils of recently boiled and cooled distilled water. Then standardize this by either of the above methods and dilute accordingly with recently boiled and cooled distilled water. Potassium permanganate V.S. made by this method, without the preliminary boiling and standing, deteriorates readily, hence the titer should be verified each time it is used. Potassium permanganate V.S. should be kept in well-closed glass-stoppered bottles, and burettes provided with glass stop-cocks must be employed in titrating with it. This solution should be restandardized frequently.

One Mil of Tenth-Normal Potassium Permanganate V.S. is the Equivalent of:

	Gramme
Potassium Permanganate, $KMnO_4$	0.0031606
Calcium Oxide, CaO (as oxalate)	0.0028035
Ferrous Carbonate, $FeCO_3$	0.011584
Ferrous Oxide, FeO	0.007184
Ferrous Sulphate, anhydrous, $FeSO_4$	0.015191
Ferrous Sulphate, crystals, $FeSO_4 + 7H_2O$	0.027802
Hydrogen Dioxide, H_2O_2	0.0017008
Iron, in ferrous compounds, Fe	0.005584
Oxalic Acid, crystallized, $H_2C_2O_4 + 2H_2O$	0.0063025
Oxygen, O	0.0008
Potassium Chlorate, $KClO_3$	0.0020427
Sodium Chlorate, $NaClO_3$	0.0017743
Sodium Nitrite, $NaNO_2$	0.0034505
Sodium Oxalate, $Na_2C_2O_4$	0.0067

Tenth-Normal Potassium Sulphocyanate Volumetric Solution

[Volhard's Solution]

KCNS = 97.18   9.718 Gm. in 1000 mils

Dissolve 11 Gm. of crystals of potassium sulphocyanate (see page 1509) in 1000 mils of distilled water.

This solution is too concentrated and has to be adjusted so as to correspond in strength exactly with tenth-normal silver nitrate V.S. For this purpose, introduce into a flask 10 mils of tenth-normal silver nitrate V.S., 3 mils of ferric ammonium sulphate T.S., and 3 mils of nitric acid (free from nitrous compounds) and dilute the liquid with about 100 mils of distilled water. To this mixture add the sulphocyanate solution from a burette in small portions at a time. At first, a white precipitate of silver sulphocyanate appears, then every drop falling from the burette is surrounded by a deep brownish-red color produced by ferric sulphocyanate which disappears on vigorous shaking of the flask as long as any of the silver nitrate remains unchanged. When all of the silver has been converted into sulphocyanate, a single additional drop of the potassium sulphocyanate solution produces a brownish-red color which no longer disappears on shaking, but communicates a perceptible pale reddish-brown tint to the contents of the flask. Note the number of mils of the potassium sulphocyanate solution used and, after having confirmed the accuracy of the titration, dilute the whole of the remaining solution so that equal volumes of this and of the tenth-normal silver nitrate V.S., at standard temperature, will be required to produce the permanent reddish-brown tint. (The same depth of pale reddish-brown tint to which the volumetric solution is adjusted must be attained when the solution is used for volumetric assays). After the dilution, a new trial should be made, in which 25 mils of tenth-normal silver nitrate V.S., at standard temperature, 5 mils of ferric ammonium sulphate T.S., 5 mils of nitric acid, and 200 mils of distilled water are used, and there should be required of the potassium sulphocyanate solution, exactly the same number of mils as of the silver nitrate solution, at standard temperature, to produce the same depth of a permanent pale reddish-brown tint. If necessary a new adjustment should be made to render the correspondence perfect.

One Mil of Tenth-Normal Potassium Sulphocyanate V.S. is the Equivalent of:

	Gramme
Potassium Sulphocyanate, KSCN	0.009718
Mercuric Iodide, HgI_2	0.022722
Mercuric Nitrate, $Hg(NO_3)_2$	0.016231
Mercuric Oxide, HgO	0.01083
Mercury, Hg	0.01003
Silver, Ag	0.010788
Silver Nitrate, $AgNO_3$	0.016989
Silver Oxide, Ag_2O	0.011588

Tenth-Normal Silver Nitrate Volumetric Solution

$AgNO_3 = 169.89$ 16.989 Gm. in 1000 mils

Into a flask containing 10.788 Gm. of silver (see page 1510), and provided with a small funnel inserted into the neck to prevent loss by spurting, introduce gradually about 30 mils of nitric acid (*Acidum Nitricum,* U. S. P.) or sufficient for complete solution. After thoroughly rinsing the funnel inside and outside, transfer the solution, which should be clear, with the rinsings of the flask to a beaker or porcelain dish and evaporate it to dryness on a water bath, carefully protecting the vessel from dust. Then after drying in an air-oven at about 120° C. for ten minutes, dissolve the residue in sufficient distilled water to measure exactly 1000 mils at standard temperature. Keep the solution in dark amber-colored, glass-stoppered vials, carefully protected from dust and sunlight.

NOTE: Titration by tenth-normal silver nitrate V.S. may be conducted in various ways, adapted to the special preparation to be tested.

A. The Titration of Soluble Chlorides and Bromides.—To the strictly neutral (to litmus) solution of an accurately weighed quantity of the salt contained in either a porcelain dish or a flask placed on a white surface add sufficient potassium chromate T.S. to impart a yellow tint, then slowly add the tenth-normal silver nitrate V.S. from a burette, stirring or agitating constantly until the mixture acquires a permanent red tint, due to the formation of red silver chromate. This method is only suitable for neutral solutions.

B. The Titration of Free Hydrobromic, Hydrochloric, and Hydriodic Acids or Their Salts in Acid Solution, Known as the Volhard, Thiocyanate, or Sulphocyanate Method of Residual Titration.—Add an accurately measured excess of tenth-normal silver nitrate V.S. to the solution of the halogen acid or its salt, and then acidify with nitric acid, and add a few mils of ferric ammonium sulphate T.S.; then determine the uncombined excess of the silver nitrate V.S. by titrating back with tenth-normal potassium sulphocyanate V.S., the end-reaction being the formation of a permanent pale reddish tint. The volume of the silver nitrate V.S. originally added, less that of the potassium sulphocyanate V.S. consumed, will give the number of mils of the former which were required for the precipitation of the halogen. The quantity of nitric acid added should be sufficient to remove the yellow color produced by the addition of the indicator.

C. Titration Until the First Appearance of a Permanent Precipitate.—This method is applicable in the estimation of the alkali cyanides and hydrocyanic acid. When the solution is used by this method, it is a fifth-normal instead of a tenth-normal solution.

One Mil of Tenth-Normal Silver Nitrate V.S. is the equivalent of:

	Gramme
Silver Nitrate, $AgNO_3$	0.016989
Allyl Iso-thiocyanate, $C_3.H_5SCN$	0.004956
Ammonium Bromide, NH_4Br	0.009796
Ammonium Chloride, NH_4Cl	0.005350
Ammonium Iodide, NH_4I	0.014496
Arsenous Iodide, AsI_3	0.015191
Bromine, Br	0.007992
Calcium Bromide, anhydrous, $CaBr_2$	0.0099955
Calcium Bromide, $CaBr_2 + 2H_2O$	0.011798
Calcium Chloride, anhydrous, $CaCl_2$	0.00555
Calcium Chloride, $CaCl_2 + 2H_2O$	0.0073511
Calcium Hypophosphite, $Ca(PH_2O_2)_2$	0.002836
Chlorine, Cl	0.003546
Ferrous Bromide, anhydrous, $FeBr_2$	0.010784
Ferrous Iodide, FeI_2	0.015484
Hydriodic Acid, HI	0.012793
Hydrobromic Acid, HBr	0.008093
Hydrochloric Acid, HCl	0.003647
Hydrocyanic Acid, HCN, to first formation of precipitate	0.005404
Hydrocyanic Acid, HCN, potassium chromate as indicator	0.002702
Iodine, I	0.012692
Lithium Bromide, LiBr	0.008686
Lithium Chloride, LiCl	0.004240
Phosphoric Acid, H_3PO_4	0.0032687
Potassium Bromide, KBr	0.011902
Potassium Chloride, KCl	0.007456
Potassium Cyanide, KCN, to first formation of precipitate	0.013022
Potassium Hypophosphite, KPH_2O_2	0.003472
Potassium Iodide, KI	0.016602
Potassium Nitrate, KNO_3	0.010111
Potassium Sulphocyanate, KCNS	0.009718
Sodium Bromide, NaBr	0.010292
Sodium Chloride, NaCl	0.005846
Sodium Cyanide, NaCN, to first formation of precipitate	0.009802
Sodium Hypophosphite, $NaPH_2O_2 + H_2O$	0.0035357
Sodium Iodide, NaI	0.014992
Sodium Nitrate, $NaNO_3$	0.008501
Sodium Phosphate, anhydrous, Na_2HPO_4	0.004735
Sodium Phosphate, crystallized, $Na_2HPO_4 + 12H_2O$	0.011941
Strontium Bromide, $SrBr_2 + 6H_2O$	0.017779
Strontium Chloride, $SrCl_2 + 6H_2O$	0.013332
Strontium Iodide, $SrI_2 + 6H_2O$	0.022479
Zinc Chloride, $ZnCl_2$	0.0068145

Hundredth-Normal Silver Nitrate Volumetric Solution

$AgNO_3 = 169.89$ 1.6989 Gm. in 1000 mils

Dilute, at standard temperature, exactly 100 mils of tenth-normal silver nitrate V.S. with sufficient distilled water at the same temperature to measure 1000 mils.

This solution should be kept in glass-stoppered, amber-colored bottles which have been rinsed with nitric acid and then with hot distilled water until all traces of the acid have been removed.

One Mil of Hundredth-Normal Silver Nitrate V.S. is the equivalent of:

	Gramme
Sodium Chloride, NaCl	0.0005846

Tenth-Normal Sodium Chloride Volumetric Solution

$NaCl = 58.46$ 5.846 Gm. in 1000 mils

Dissolve 5.846 Gm. of sodium chloride (see page 1512) in sufficient distilled water to measure exactly 1000 mils at standard temperature.

Tenth-normal sodium chloride V.S. should correspond, volume for volume, with tenth-normal silver nitrate V.S., by titrating 20 mils of the former with the latter, using potassium chromate as indicator.

One Mil of Tenth-Normal Sodium Chloride V.S. is the equivalent of:

	Gramme
Sodium Chloride, NaCl	0.005846
Silver, Ag	0.010788
Silver Nitrate, $AgNO_3$	0.016989
Silver Oxide, Ag_2O	0.011588

Double-Normal Sodium Hydroxide Volumetric Solution

$NaOH = 40.01$ 80.02 Gm. in 1000 mils

Dissolve 90 Gm. of sodium hydroxide (*Sodii Hydroxidum*, U. S. P.) in sufficient recently boiled distilled water to measure about 1000 mils.

For the standardization of this trial solution of sodium hydroxide proceed as directed under normal potassium hydroxide V.S.; each 25 mils of the volumetric solution, at standard temperature, should exactly neutralize 9.407 Gm. of potassium bitartrate (see page 1507) or 50 mils of normal sulphuric acid V.S.

NOTE: The same precautions should be taken for protecting this solution from the carbon dioxide of the air as are prescribed for normal potassium hydroxide V.S.

Normal Sodium Hydroxide Volumetric Solution

$NaOH = 40.01$ 40.01 Gm. in 1000 mils

Dissolve 50 Gm. of sodium hydroxide (*Sodii Hydroxidum*, U. S. P.) in sufficient recently boiled distilled water to measure about 1050 mils. For the standardization of this trial solution of sodium hydroxide, proceed as directed under normal potassium hydroxide V.S.; 25 mils of the volumetric solution, at standard temperature, must exactly neutralize 4.7035 Gm. of potassium bitartrate or 25 mils of normal sulphuric acid V.S.

NOTE: The same precautions should be taken for protecting this solution from the carbon dioxide of the air as are prescribed for normal potassium hydroxide V.S. This solution may be employed in place of the normal potassium hydroxide V.S., volume for volume.

One Mil of Normal Sodium Hydroxide V.S. is the equivalent of:

	Gramme
Sodium Hydroxide, NaOH	0.04001
Boric Acid, H_3BO_3	0.06202
Formaldehyde, CH_2O	0.03002
Trichloracetic Acid, $HC_2O_2Cl_3$	0.16339

Tenth-Normal Sodium Thiosulphate Volumetric Solution

$Na_2S_2O_3 + 5H_2O = 248.22$ 24.822 Gm. in 1000 mils

Dissolve 30 Gm. of sodium thiosulphate (see page 1513) in sufficient distilled water, previously boiled for twenty minutes in a flask of hard glass and quickly cooled, to measure 1000 mils. This trial solution, which is too concentrated, is standardized as follows:

To 25 mils of tenth-normal potassium dichromate V.S., accurately measured, at standard temperature, into a glass-stoppered flask of about 500 mils capacity, add about 2 Gm. of potassium iodide (*Potassii Iodidum,* U. S. P.) (free from iodate), followed by 10 mils of diluted sulphuric acid. Rinse the walls of the flask cautiously with about 200 mils of cold distilled water poured in carefully so as not to mix, thus protecting the lower layer from loss of iodine. Stopper the flask securely and set it aside for half an hour in a dark place, then carefully rinse the stopper and sides of the flask with distilled water and add slowly the trial solution of sodium thiosulphate, at standard temperature, while rotating the flask gently. When the solution has assumed a yellowish-green color, add starch T.S. and then reduce the flow of the sodium thiosulphate solution to drops, constantly shaking until the blue color of the mixture changes to a light green; note the number of mils of the trial sodium thiosulphate solution consumed. Then dilute the sodium thiosulphate solution with distilled water which has been previously boiled for twenty minutes so that equal volumes of it and the tenth-normal potassium dichromate V.S. will exactly correspond to each other under the above conditions at standard temperature.

NOTE: The same precautions should be taken for keeping and protecting this solution from the carbon dioxide of the air as are directed under normal potassium hydroxide V. S.

One Mil of Tenth-Normal Sodium Thiosulphate V.S. is the equivalent of:

	Gramme
Sodium Thiosulphate, $Na_2S_2O_3 + 5H_2O$	0.024822
Bromine, Br	0.007992
Chlorine, Cl	0.003546
Chromium Trioxide, CrO_3	0.003333
Copper Sulphate, anhydrous, $CuSO_4$	0.015964
Copper Sulphate, crystallized, $CuSO_4 + 5H_2O$	0.024972
Iodine, I	0.012692
Iodine, I (Thymol Iodide)	0.002115
Iron, Fe, in ferric salts	0.005584
Lead Peroxide, PbO_2	0.01195
Potassium Bromate, $KBrO_3$	0.0027837
Potassium Dichromate, $K_2Cr_2O_7$	0.0049033
Sodium Arsenate, anhydrous, Na_2HAsO_4	0.0092985
Sodium Arsenate, crystallized, $Na_2HAsO_4 + 7H_2O$	0.015604

Two-Hundredth-Normal Sodium Thiosulphate Volumetric Solution

$Na_2S_2O_3 + 5H_2O = 248.22$ 1.2411 Gm. in 1000 mils

Dilute exactly 25 mils, at standard temperature, of tenth-normal sodium thiosulphate V.S. with sufficient distilled water at the same temperature and recently boiled for twenty minutes to measure 500 mils. If desired, this solution may be standardized in the manner described under tenth-normal sodium thiosulphate V.S., employing 5 mils of tenth-normal potassium dichromate V.S. which should require for the decolorization of the liberated iodine, 100 mils of the two-hundredth-normal sodium thiosulphate V.S. The same precautions should be observed in the preservation of this solution as directed under tenth-normal sodium thiosulphate V.S.

One Mil of Two-Hundredth-Normal Sodium Thiosulphate V.S. is the equivalent of:

	Gramme
Sodium Thiosulphate, $Na_2S_2O_3 + 5H_2O$	0.0012411
Iodine, I	0.0006346
Iodine, I (from Thyroid Glands)	0.0001058

Normal Sulphuric Acid Volumetric Solution

$H_2SO_4 = 98.09$ 49.045 Gm. in 1000 mils

Carefully mix 30 mils of pure, concentrated sulphuric acid (*Acidum Sulphuricum,* U. S. P.) with sufficient distilled water to measure about 1050 mils, and allow the liquid to cool to 25° C. Measure from a burette 25 mils of this liquid (which is yet too concentrated) into a flask, add about 50 mils of distilled water and 2 drops of methyl orange T.S. and afterwards, from a burette, a freshly standardized normal potassium hydroxide V.S., shaking after each addition, and toward the end of the operation reducing the flow to drops, until the red tint of the solution changes to a permanent pale yellow after thorough shaking. Note the number of mils of normal potassium hydroxide V.S. consumed. Then dilute the sulphuric acid solution so that equal volumes of this and of normal potassium hydroxide V.S., at standard temperature, exactly neutralize each other.

Alternative Method.—The diluted trial acid may be directly standardized as follows: Weigh accurately about 2 Gm. of anhydrous sodium carbonate (prepared as directed on page 1511), dissolve it in 100 mils of distilled water contained in a flask, add from 2 to 3 drops of methyl orange T.S., then run in, little by little from a burette the acid solution to be standardized. Agitate the flask after each addition, reducing the flow of the acid to drops toward the end of the titration; the termination of the operation or exact saturation is indicated by a change in the color of the solution from orange to red or pink. A second or third trial should be made with other weighed portions of the sodium carbonate and in each experiment the number of mils consumed should be accurately noted and the results should agree closely. One gramme of anhydrous sodium carbonate requires for exact neutralization 18.868 (18.8679) mils of normal sulphuric acid V.S. at standard temperature.

Example: 2.25 Gm. of anhydrous sodium carbonate required 37.6 mils of the trial acid for neutralization,* then:

$$42.453 : 37.6 : : 100 : x \quad x = 88.57 \text{ mils}$$

In a second trial 2.12 Gm. of the soda required 35.43 mils of the trial acid for neutralization, then:

$$40.00 : 35.43 : : 100 : x \quad x = 88.575$$

The acid may now be adjusted by measuring 885.72 mils (average) into a graduated liter flask and filling to the liter mark with distilled water at standard temperature. A new adjustment must be made to prove the accuracy of the standardization, using about 3 Gm., accurately weighed, of the sodium carbonate.

One Mil of Normal Sulphuric Acid V.S. is the equivalent of:

	Gramme
Sulphuric Acid, H_2SO_4	0.049045
Ammonia Gas, NH_3	0.01703
Ammonium Acetate, $NH_4C_2H_3O_2$	0.07707
Ammonium Carbonate, $(NH_4)_2CO_3$	0.04804
Ammonium Carbonate (U. S. P.), $NH_4HCO_3.NH_4NH_2CO_2$	0.052373
Calcium Hydroxide, $Ca(OH)_2$	0.037045
Calcium Oxide, CaO	0.028035
Lead Acetate, crystallized, $Pb(C_2H_3O_2)_2 + 3H_2O$	0.18960
Lead Subacetate, assumed as $Pb_2O(C_2H_3O_2)_2$	0.13706
Lithium Carbonate, Li_2CO_3	0.03694
Lithium Salicylate, $LiC_7H_5O_3$	0.14398
Magnesium Carbonate, $(MgCO_3)_4Mg(OH)_2 + 5H_2O$	0.04857
Magnesium Oxide, MgO	0.02016
Potassium Acetate, $KC_2H_3O_2$	0.09812
Potassium Bicarbonate, $KHCO_3$	0.10011
Potassium Bitartrate, $KHC_4H_4O_6$	0.18814
Potassium Carbonate, anhydrous, K_2CO_3	0.06910

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*2.25 Gm. of anhydrous sodium carbonate requires $2.25 \times 18.868 = 42.4528$ mils of normal sulphuric acid V.S.

	Gramme
Potassium Citrate, crystallized, $K_3C_6H_5O_7 + H_2O$	0.10812
Potassium Hydroxide, KOH	0.05611
Potassium and Sodium Tartrate, $KNaC_4H_4O_6 + 4H_2O$	0.14110
Sodium Acetate, $NaC_2H_3O_2 + 3H_2O$	0.13607
Sodium Bicarbonate, $NaHCO_3$	0.08401
Sodium Borate, crystallized, $Na_2B_4O_7 + 10H_2O$	0.19108
Sodium Carbonate, anhydrous, Na_2CO_3	0.0530
Sodium Carbonate monohydrated, $Na_2CO_3 + H_2O$	0.06201
Sodium Hydroxide, $NaOH$	0.04001
Sodium Salicylate, $NaC_7H_5O_3$	0.16004
Zinc Oxide, ZnO	0.040685

Half-Normal Sulphuric Acid Volumetric Solution

$H_2SO_4 = 98.09$ 24.5225 Gm. in 1000 mils

Dilute 500 mils of normal sulphuric acid V.S. at standard temperature with sufficient distilled water at the same temperature to measure 1000 mils.

This standard solution is chiefly employed in the titration of the organic salts of sodium and potassium in conjunction with methyl orange T.S. as indicator. For this purpose a special experiment should be made in which an accurately measured volume of 10 mils of normal potassium hydroxide V.S. should, after adding 2 drops of methyl orange T.S., require exactly 20 mils of the half-normal sulphuric acid V.S., at standard temperature, for neutralization. If necessary, an adjustment should be made to render the correspondence perfect.

One Mil of Half-Normal Sulphuric Acid V.S. is the equivalent of:

	Gramme
Sulphuric Acid, H_2SO_4	0.024523
Ammonia Gas, NH_3	0.008515
Lithium Citrate, anhydrous, $Li_3C_6H_5O_7$	0.034977
Lithium Citrate, crystallized, $Li_3C_6H_5O_7 + 4H_2O$	0.04699
Lithium Salicylate, $LiC_7H_5O_3$	0.07199
Potassium and Sodium Tartrate, anhydrous, $KNaC_4H_4O_6$	0.05253
Potassium and Sodium Tartrate, crystallized, $KNaC_4H_4O_6 + 4H_2O$	0.07055
Potassium Acetate, $KC_2H_3O_2$	0.04906
Potassium Bicarbonate, $KHCO_3$	0.050055
Potassium Bitartrate, $KHC_4H_4O_6$	0.09407
Potassium Citrate, anhydrous, $K_3C_6H_5O_7$	0.051057
Potassium Citrate, crystallized, $K_3C_6H_5O_7 + H_2O$	0.05406
Potassium Hydroxide, KOH	0.02806
Sodium Acetate, anhydrous, $NaC_2H_3O_2$	0.04101
Sodium Acetate, $NaC_2H_3O_2 + 3H_2O$	0.068035
Sodium Benzoate, $NaC_7H_5O_2$	0.07202
Sodium Bicarbonate, $NaHCO_3$	0.04200
Sodium Carbonate, anhydrous, Na_2CO_3	0.02650
Sodium Carbonate, monohydrated, $Na_2CO_3 + H_2O$	0.031005
Sodium Citrate, anhydrous, $Na_3C_6H_5O_7$	0.04301
Sodium Citrate, crystallized $Na_3C_6H_5O_7 + 2H_2O$	0.04901
Sodium Salicylate, $NaC_7H_5O_3$	0.08002
Sodium Tartrate, neutral, $Na_2C_4H_4O_7 + 2H_2O$	0.057515

Tenth-Normal Sulphuric Acid Volumetric Solution

$H_2SO_4 = 98.09$ 4.9045 Gm. in 1000 mils

Dilute 100 mils of normal sulphuric acid, at standard temperature, with sufficient distilled water at the same temperature to measure 1000 mils.

Alternative Method.—Mix about 5 mils of concentrated sulphuric acid (specific gravity 1.826 at 25° C.) with sufficient distilled water to measure about 1100 mils, and allow it to cool to 25° C. Standardization should be carried out as directed under the alternative method for normal sulphuric acid V.S., employing about 0.3 Gm. of anhydrous sodium carbonate (see page 1511), accurately weighed, with methyl orange T.S. as indicator. One decigramme of anhydrous sodium carbonate should require for neutralization 18.868 (18.8679) mils of the tenth-normal acid V.S. at standard temperature. This standard solution is employed in conjunction with the fiftieth-normal potassium hydroxide V.S. in the titration of alkaloids, with cochineal, iodeosin, methyl red, or hematoxylin T.S. as indicator. For this purpose a special experiment should be made, in which an accurately measured volume of 10 mils of the tenth-normal sulphuric acid, after adding a sufficient quantity of the indicator to be employed, should require 50 mils of the fiftieth-normal potassium hydroxide V.S. at standard temperature for complete neutralization.

One Mil of Tenth-Normal Sulphuric Acid V.S. is the equivalent of:

	Gramme
Sulphuric Acid, H_2SO_4	0.0049045
Aconite, ether soluble alkaloids	0.0645
Aconitine, $C_{34}H_{47}O_{11}N$	0.064539
Atropine, $C_{17}H_{23}O_3N$	0.028919
Brucine, $C_{23}H_{26}O_4N_2$	0.039423
Calcium Hydroxide, $Ca(OH)_2$	0.0037045
Cephaeline, $C_{14}H_{19}O_2N$	0.023316
Cinchonidine, $C_{19}H_{22}ON_2$	0.029420
Cinchonine, $C_{19}H_{22}ON_2$	0.029420
Cocaine, $C_{17}H_{21}O_4N$	0.030318
Coniine, $C_8H_{17}N$	0.012715
Emetine, $C_{15}H_{21}O_2N$	0.024718
Hydrastine, $C_{21}H_{21}O_6N$	0.038318
Ipecac, ether soluble alkaloids of	0.0240
Morphine, anhydrous, $C_{17}H_{19}O_3N$	0.028516
Morphine, crystallized, $C_{17}H_{19}O_3N + H_2O$	0.030318
Mydriatic Alkaloids, combined	0.02892
Nux Vomica, combined alkaloids of	0.0364
Physostigmine, $C_{15}H_{21}O_2N_3$	0.027520
Pilocarpine, $C_{11}H_{16}O_2N_2$	0.020815
Potassium Hydroxide, KOH	0.005611
Quinine, anhydrous, $C_{20}H_{24}O_2N_2$	0.032421
Sodium Carbonate, anhydrous, Na_2CO_3	0.00530
Strychnine, $C_{21}H_{22}O_2N_2$	0.033420
Zinc Oxide, ZnO	0.0040685

Fiftieth-Normal Sulphuric Acid Volumetric Solution

$H_2SO_4 = 98.09$ 0.9809 Gm. in 1000 mils

Dilute 20 mils of normal sulphuric acid V.S., or preferably 200 mils of tenth-normal sulphuric acid V.S., at 25° C., with sufficient distilled water at the same temperature to measure 1000 mils. The strength of this solution must be adjusted so that 25 mils of it will exactly neutralize 25 mils of a recently standardized fiftieth-normal potassium hydroxide V.S. at standard temperature, cochineal, iodeosin, methyl red, or hematoxylin T.S. being used as indicator.

One Mil of Fiftieth-Normal Sulphuric Acid V.S. is the equivalent of:

	Gramme
Sulphuric Acid, H_2SO_4	0.0009809
Aconitine, $C_{34}H_{47}O_{11}N$	0.012907
Atropine, $C_{17}H_{23}O_3N$	0.0057838
Cinchoma, combined alkaloids of	0.0061841
Cinchonidine, $C_{19}H_{22}ON_2$	0.005884
Cinchonine, $C_{19}H_{22}ON_2$	0.005884
Cocaine, $C_{17}H_{21}O_4N$	0.0060636
Coniine, $C_8H_{17}N$	0.002543
Hydrastine, $C_{21}H_{21}O_6N$	0.0076636
Ipecac, combined alkaloids of	0.0048034
Morphine, anhydrous, $C_{17}H_{19}O_3N$	0.0057032
Morphine, crystallized, $C_{17}H_{19}O_3N + H_2O$	0.0060636
Physostigmine, $C_{15}H_{21}O_2N_3$	0.005504

	Gramme
Pilocarpine, $C_{11}H_{16}O_2N_2$	0.004163
Quinine, anhydrous, $C_{20}H_{24}O_2N_2$	0.0062842
Strychnine, $C_{21}H_{22}O_2N_2$	0.006684

Indicators

NOTE: Each test solution used as indicator must be examined as soon as prepared, and afterwards, from time to time, as to its neutrality. If necessary, it is brought, by the cautious addition of highly diluted sulphuric acid or of a very dilute solution of an alkali to such a point that when three drops of it are added to 25 mils of distilled water, a few drops of a hundredth-normal acid or alkali V.S., respectively, will distinctly develop the appropriate tints. Test solutions are injured by exposure to light, and it is best to preserve them in dark amber-colored vials. Keep test papers in dark bottles.

Azolitmin.—A purified coloring matter from litmus. In very dark to black-violet scales or as a reddish-brown powder, slightly soluble in water, insoluble in alcohol or ether. To test its relative sensitiveness, prepare a solution of 0.1 Gm. of azolitmin in 40 mils of distilled water by the aid of a gentle heat, then add 10 mils of alcohol and filter the liquid when cold. To about 50 mils of distilled water, which has previously *been boiled* (to free it from dissolved carbonic acid) and quickly cooled, add 0.1 mil of the trial solution; the resulting bluish-red solution assumes at once a distinctly red color upon the addition of 3 drops of fiftieth-normal sulphuric acid V.S. and under the same conditions a bluish-violet color upon the addition of 0.5 mil of hundredth-normal sodium hydroxide V.S.

Azolitmin Test Solution.—Dissolve 1 Gm. of azolitmin in 80 mils of distilled water and 20 mils of alcohol in a flask and sterilize the solution by heating it in a current of steam for one hour.

Cochineal Test Solution.—Macerate 1 Gm. of unbroken official cochineal during four days with 20 mils of alcohol and 60 mils of distilled water, then filter. The color of this test solution is turned violet by alkalies, and yellowish-red by acids. Cochineal T.S. is useful in titrating alkaloids, inorganic acids, ammonia, the alkalies, and alkaline earths. The presence of salts of iron, aluminum, or copper must be avoided. This indicator is useless for titrating organic acids.

Congo Red (Dianil Red, Kosmos Red Extra).—The sodium salt of benzidin-diazo-bis-1-naphthylamine-4-sulphonic acid, $(C_6H_4N : N.C_{10}H_5(NH_2)SO_3Na)_2$. A brownish-red powder, readily soluble in warm water, yielding a blood-red solution; slightly soluble in cold water, insoluble in ether or chloroform. The addition of tannic acid T.S. to an aqueous solution (1 in 20) intensifies the color of congo red, but causes no precipitation (reaction for *basic color*). The addition of 5 mils of stannous chloride T.S. to 10 mils of an aqueous solution of congo red (1 in 10), followed by agitation and warming on a water bath, produces a violet precipitate. When filtered, the colorless filtrate does not again assume its red color when exposed to the air (test for *azo-group*). The addition of a 15 per cent. solution of sodium hydroxide to an aqueous solution of congo red (1 in 200) produces no change. The addition of hydrochloric acid to an aqueous solution of this dye (1 in 200) produces a violet precipitate. Concentrated sulphuric acid dissolves congo red with a slate blue color and, upon the cautious addition of distilled water, a blue precipitate is produced.

Congo Red Test Solution.—Dissolve 0.5 Gm. of congo red in 90 mils of distilled water and add 10 mils of alcohol. Add 2 or 3 drops of congo red test solution to 100 mils of distilled water contained in a porcelain dish; the red color of this solution changes to violet upon the addition of one drop of fiftieth-normal sulphuric acid V.S., and again changes to red upon the further addition of one drop of fiftieth-normal potassium hydroxide V.S. (*relative sensitiveness*).

Hematoxylin (Hydroxybrasilin), $C_{16}H_{14}O_6 + 3H_2O$.—A crystalline substance derived from the heart-wood of *Hæmatoxylon Campechianum* Linné (Fam. *Leguminosæ*). Colorless to yellowish prisms; very slightly soluble in cold water or ether, readily soluble in hot water or alcohol. When exposed to light, hematoxylin acquires a red color and yields yellow solutions. In ammonia water or in carbonated or caustic alkali solutions it yields a purple solution. Keep hematoxylin and its solution protected from light and air. When dissolved in aqueous solutions of the following salts, hematoxylin develops the colors indicated: in alum solution a red color; in stannous chloride solution a rose color; in solutions of copper salts a greenish-gray color; and it gradually turns black in potassium dichromate solution.

Hematoxylin Test Solution.—Dissolve 0.02 Gm. of hematoxylin in 10 mils of alcohol. Use about 5 drops for each titration. This indicator assumes a yellow to orange color in acid solutions, and a violet to purple color in alkaline solutions. The titration is complete when the change in color remains permanent upon the addition of one drop of the volumetric solution after stirring the liquid.

Iodeosin (Tetraiodofluorescein), $C_{20}H_8I_4O_5$.—A scarlet, crystalline powder, soluble in alcohol with a deep red color and in ether with a yellowish-red color. It is insoluble in water containing a trace of hydrochloric acid. It is not suitable for use as an indicator unless a test solution prepared from it (see below) will stand the following test of sensitiveness: Into a well-rinsed, colorless, glass-stoppered flask introduce 100 mils of distilled water containing 5 drops of iodeosin T.S. followed by about 30 mils of ether. Then add, drop by drop, from a burette hundredth-normal hydrochloric acid V.S., vigorously shaking it after the addition of each drop until the aqueous layer just becomes colorless. After the addition of 5 more drops of the iodeosin T.S. and again shaking, the aqueous layer does not acquire a pink color; should it do so, the color must be discharged upon the addition of 1 drop of hundredth-normal hydrochloric acid V.S. (test of *sensitiveness*).

Iodeosin Test Solution.—Dissolve 0.1 Gm. of iodeosin in 100 mils of alcohol. This indicator becomes colorless in acid solutions, changing to pink in alkaline solutions. Dilute the solution to be titrated with distilled water to about 100 mils in a 200 mil flask, add 20 mils of ether and 5 drops of the iodeosin T.S., cork and shake it well. Then add the volumetric alkali solution gradually, shaking it well after each addition. The titration is complete when the lower aqueous solution retains a faint pink color after shaking thoroughly. For assaying alkaloidal residues, dissolve the latter in a measured excess of volumetric acid solution, and transfer the acid solution to a 200 mil flask, washing the container well with distilled water until the contents of the flask measure about 100 mils. Then proceed as above. Frequently a scum forms between the ethereal and aqueous layer, in which case this assumes a pink color before the latter.

Litmus Paper and Test Solution.—Exhaust powdered litmus with three separate and successive portions (each equal to about 4 times its weight) of boiling alcohol (which removes the undesirable color erythrolitmin), each extraction lasting for about one hour. After draining off the alcohol, digest the residue with about an equal weight of cold water and filter. (This blue solution, which contains some alkali, after being acidulated, may be used to make red litmus paper). Finally extract the residue with about 5 times its weight of boiling distilled water, and, after thoroughly cooling, filter. The addition of 1 drop of hundredth-normal acid or alkali V.S. to 50 mils of distilled water containing 5 drops of the indicator produces a distinct change in color. Preserve the filtrate, as a test solution, in wide-mouthed bottles stoppered with loose plugs of purified cotton so as to exclude dust but admit air. The latter must be free from acid or ammoniacal vapors. The blue color of litmus test solution is changed by acids to red, and this red color by the addition of alkalies is restored to blue.

Litmus Paper, Blue.—Impregnate with the test solution just described strips of white filter paper, and dry them by suspending them on lines of clean twine, in an atmosphere free from acid or ammoniacal vapors. This paper must quickly respond to a two hundred and fiftieth-normal acid V.S.

Litmus Paper, Red.—Prepare this with the same kind of paper and in the manner described under *Litmus Paper, Blue*, having added to the test solution used to impregnate the paper just sufficient of a highly diluted solution of hydrochloric acid to impart to it a faint red tint. Neither blue nor red litmus paper should have an intense color. Preserve the test paper in bottles, so as to exclude dust and acid or ammoniacal vapors. This paper must quickly respond to a two hundred and fiftieth-normal alkali V.S.

Methyl Orange (Helianthin, Orange III, Tropæolin D., Dimethylaniline Orange.—The sodium salt of paradimethylaminoazobenzene sulphonic acid, $(CH_3)_2—N—C_6H_4—N=N—C_6H_4.SO_3Na$.— An orange-yellow powder, readily soluble in hot water, the solution on cooling separating golden-yellow scales. Slightly soluble in cold water, yielding an orange-yellow solution. Insoluble in alcohol. An aqueous solution (1 in 500), upon the addition of hydrochloric acid, yields a red precipitate soluble in excess of the acid with a deep red color. The addition of calcium chloride T.S. to the aqueous solution of methyl orange (1 in 500) precipitates the insoluble calcium salt. The addition of solution of lead subacetate (*Liquor Plumbi Subacetatis,* U. S. P.) precipitates the coloring matter from an aqueous solution. Sulphuric acid dissolves methyl orange with a blood-red color.

Methyl Orange Test Solution.—Dissolve 1 Gm. of methyl orange (see above) in 1000 mils of distilled water. Excessive quantities of this indicator should be avoided in titration; from 1 to 3 drops are sufficient for a volume of from 50 to 100 mils, or add just enough to impart a faint tint to the solution, which if alkaline or neutral will assume a pure yellow, if faintly acid, an orange, and when strongly acid, a rose red color. The solution must comply with the following requirements for sensitiveness as an indicator: To 100 mils of distilled water, contained in a flask of Jena glass, add 1 drop of the Test Solution; the pale yellow color of the solution, upon the addition of 0.5 mil of hundredth-normal sulphuric acid V.S. changes to a rose color; the yellow color will be restored upon the further addition of 0.5 mil of hundredth-normal potassium hydroxide V.S. Methyl orange is suitable for titrating inorganic acids, alkalies, alkali carbonates or bicarbonates. It is not to be employed in titrating organic acids, nor in alcoholic or boiling solutions. This indicator gives a yellow color with alkalies and rose color with acids.

Methyl Red (Paradimethylaminoazobenzeneorthocarboxylic acid), $(CH_3)_2-N-C_6H_4-N=N-C_6H_4.COOH$.—Violet crystals, very slightly soluble in cold water, yielding a red solution, readily soluble in alcohol and glacial acetic acid. When dissolved in sulphuric acid, methyl red shows the same color change as methyl orange. The applications of methyl red as indicator are the same as those of methyl orange, except that when titrating solutions containing carbonates it should not be used (see above).

Methyl Red Test Solution.—Dissolve 0.2 Gm. of methyl red in 100 mils of alcohol. As an indicator from 1 to 3 drops are sufficient for a volume of 100 mils, or add just sufficient to impart a faint tint to the solution, which if alkaline will assume a pure yellow, and when faintly acid a rose-red, or when strongly acid a violet-red color. The solution must comply with the following requirements for sensitiveness as an indicator: To 100 mils of distilled water which has been freed from carbon dioxide by boiling in a flask of hard glass, add 2 drops of methyl red T.S.; the yellowish-red color of 50 mils of this solution is changed to pure yellow by the addition of 2 drops of hundredth-normal potassium hydroxide V.S., and the color of the other 50 mils is changed to red by 2 drops of hundredth-normal hydrochloric acid V.S. Methyl red T.S., which is not affected by neutral salts, may be used in all instances where methyl orange is indicated, except where carbon dioxide is present; its end-points are sharper than those of methyl orange, and it is far more sensitive in the titration of very dilute solutions of weak bases, surpassing hematoxylin or iodeosin in the titration of alkaloids.

Phenolphthalein Test Solution.—Dissolve 1 Gm. of official phenolphthalein in 100 mils of alcohol. About 3 drops are sufficient for 50 mils of the solution to be titrated; it gives a red color with alkali hydroxides or carbonates, and acids render the solution colorless. The test solution must comply with the following requirements for sensitiveness as an indicator: From 3 to 5 drops of the test solution are added to 300 mils of distilled water which has been previously boiled and cooled in a flask of Jena glass; this solution is colored red by the addition of not more than 0.5 mil of hundredth-normal potassium hydroxide V.S. Phenolphthalein may be employed in hot titrations. It is not suitable as an indicator for ammonia nor in the presence of large quantities of ammonium salts, but is largely used for organic acids, alkali hydroxides, and for carbonates and bicarbonates in boiling solutions.

Phenolphthalein Paper is prepared by impregnating white, unsized paper with the test solution and drying it.

Rosolic Acid, Corallin.—Amorphous reddish-brown powder or lumps, the latter having a greenish, metallic luster, consisting chiefly of the compound $C_{20}H_{16}O_3$, isomeric with methylaurin and homologous with aurin. Rosolic acid is soluble in alcohol and insoluble in water.

Rosolic Acid Test Solution.—Dissolve 1 Gm. of rosolic acid in 10 mils of diluted alcohol, and add enough distilled water to make 100 mils. Of this solution, about 0.5 mil is used for 100 mils of solution to be titrated. Its color is pale yellow, unaffected by acids, but turning to rose with alkalies. The solution must comply with the following requirements for sensitiveness as an indicator: To 100 mils of distilled water, add 2 drops of the test solution; the pale yellow color of this solution, upon the addition of 0.5 mil of hundredth-normal potassium hydroxide V.S., changes to a rose-red; the yellow color will be restored upon the further addition of 0.5 mil of hundredth-normal sulphuric acid V.S. Ammoniacal solutions are to be highly diluted when titrated with this indicator. It is useful for mineral but useless for organic acids, except oxalic.

Turmeric Tincture.—Digest any convenient quantity of ground turmeric root (from *Curcuma longa* Linné, Fam. *Scitaminaceæ*) repeatedly with small quantities of distilled water and discard the liquids. Then digest the dried residue for several days with six times its weight of alcohol, and filter.

Turmeric Paper.—Impregnate white, unsized paper with the tincture, and dry it. The tincture, as well as the paper, turns brown with alkalies, and the original yellow color is restored by acids, with the exception of boric acid, which, especially in the presence of hydrochloric acid, turns the color to reddish-brown, which is changed to bluish-black by ammonia.

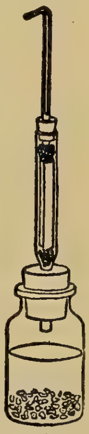
General Tests

Under this head are placed tests which are frequently duplicated throughout the Pharmacopœia. In order to save space they are here grouped together and in the text are referred to by number.

1. Arsenic Test

Test Apparatus.—Prepare several generators, equipped with tubes, etc., as described below. Select as a generator a bottle of about 50 mils capacity, having a mouth about 2.5 cm. in diameter and provide a well fitting rubber stopper, suitably perforated. In the perforation in this stopper insert a vertical exit tube about 13 cm. in total length and 1 cm. in diameter throughout the upper portion (for about 10 cm.) and constricted at its lower extremity to a tube of about 3 cm. in length and about 5 mm. in diameter. This latter tube should extend but slightly below the stopper. In the lower part of the wider exit tube insert a small pledget of dry glass wool and then a strip of the freshly prepared but dry lead acetate test paper rolled into a coil, and above this a plug of the moist (not wet) lead acetate glass wool. In the upper extremity of this tube insert through a perforated cork stopper, a glass tube 12 cm. in length, having an internal diameter of about 3 mm. Place the mercuric bromide test paper in this tube, bending or creasing the upper portion of the strip so that it will retain its position. The strip should extend within about 2 cm. of the perforated cork stopper and must not be introduced into the tube until ready to start the test. This tube should be thoroughly cleaned and dried each time it is used.

Fig. 465



Test Apparatus

Standard Arsenic Test Solution.—Dissolve 0.1 Gm. of official arsenic trioxide, which has been finely pulverized, dried in a desiccator, and accurately weighed, in about 5 mils of a 20 per cent. solution of sodium hydroxide (free from arsenic). Neutralize the solution with diluted sulphuric acid (free from arsenic), add 10 mils of the same acid and sufficient recently boiled distilled water to bring the volume of the solution to exactly 1000 mils at 25° C. Accurately measure 10 mils of this solution, transfer it to a 1000 mil flask, add 10 mils of diluted sulphuric acid (free from arsenic) and make up the volume with recently boiled distilled water to exactly 1000 mils at 25° C. Employ this solution, containing 0.001 milligramme of arsenic trioxide in each 1 mil (at 25° C.), in preparing the standard stain. Keep this solution in a glass-stoppered bottle. It is advisable to make fresh solutions whenever new standard stains are to be prepared.

Preparation of the Chemical to be Tested.—Add 1 mil of a mixture of equal volumes of concentrated sulphuric acid (see page 1515) and distilled water, to 5 mils of an aqueous solution of the chemical (1 in 25) or to a solution in 5 mils of distilled water of the residue remaining after any special treatment that may be directed. This acidulation is not necessary in the case of inorganic acids. Now, unless specially directed, add 10 mils of a saturated aqueous solution of sulphurous acid. Evaporate this liquid in a small beaker, on a water bath, until it is free from sulphurous acid and has been reduced to about 2 mils in volume. Dilute this evaporated liquid to about 5 mils with distilled water.

THE TEST FOR ARSENIC

Preparation of the Standard Stain.—Introduce into the generator from 8 to 10 Gm. of zinc followed by 25 mils of dilute sulphuric acid, prepared by mixing 1 part of concentrated sulphuric acid, free from arsenic (see page 1515), with 4 parts of distilled water, and 5 drops of acid stannous chloride T.S. Add at once 2 mils (accurately measured at 25° C.) of the standard arsenic T.S. (see page 1539), and immediately insert the stopper containing the exit tube, into which have been placed the glass wool pledget, the dry lead acetate test paper, the moist lead acetate glass wool, and the mercuric bromide test paper, as described under the *Test Apparatus.* Should the evolution of the gas be violent at first, check the reaction by immersing the bottle in cold water. Should the reaction subside, increase it by placing the bottle in warm water. If the reaction be too violent, the stain will spread and not form a distinctive band, thus making the comparisons of color intensity difficult. After the test has continued for forty-five minutes, remove the mercuric bromide test paper and place it in a clean, dry tube for comparison. This stain represents 0.002 milligramme of arsenic trioxide in addition to any stain produced by the reagents. The stain from the reagents should scarcely be perceptible when determined by a blank experiment. Since light, heat and moisture cause the stain to fade rapidly, comparison should be made as soon as possible. The stained test papers may be preserved by either dipping in hot, melted paraffin or keeping them over phosphoric anhydride protected from light.

Testing the Chemical.—Introduce into another generator from 8 to 10 Gm. of the zinc, followed by 25 mils of the dilute sulphuric acid (1 to 4) and 5 drops of acid stannous chloride T.S. Insert the stopper containing the exit tube charged with the test papers and glass wool, as just described. Then add 5 mils of the solution to be tested, previously treated as directed, under *Preparation of the Chemical,* and immediately insert the stopper charged with the test papers and glass wool. When the evolution of hydrogen has proceeded actively for forty-five minutes, remove the mercuric bromide test paper and carefully compare it with the standard stain prepared as described above. The stain produced by the chemicals tested does not exceed in length or intensity of color that prepared as the standard, indicating not more than 1 part of arsenic in 100,000 parts of the substance tested.

Interfering Chemicals.—*Antimony,* if present in the substance tested, will produce a gray stain. *Sulphites, sulphides, thiosulphates,* and other compounds which liberate hydrogen sulphide or sulphurous acid when treated with sulphuric acid, must be oxidized by means of nitric acid and then reduced by means of sulphurous acid as directed under *Preparation of the Chemical to be Tested,* before introducing them into the apparatus. *Sulphur compounds* as well as *hydrogen phosphide* give a bright yellow band on the test paper. If sulphur compounds are present, a simultaneous darkening of the lead acetate test paper and glass wool will occur. If such is the case, the operation as directed under *Preparation of the Chemical to be Tested* must be repeated upon a fresh portion of the solution being tested, using greater care in effecting the complete removal of the sulphurous acid. In testing hypophosphites special care should be observed to completely oxidize the solution being tested as directed, otherwise a yellow stain may be produced through the evolution of hydrogen phosphide, which might be confused with the orange-yellow color produced by arsenic. *Compounds containing antimony* should be tested for *arsenic* by Bettendorf's Test (see Test No. 2).

The test apparatus should be thoroughly cleaned and dried immediately before and after use.

2. Arsenic Test, Bettendorf's

This test is employed only in testing salts of *bismuth* and compounds containing *antimony* for the presence of arsenic.

To a solution of the prescribed quantity of the substance to be tested in 5 mils of concentrated hydrochloric acid (see page 1501) contained in a clean test tube, add 10 mils of saturated stannous chloride T.S. which has been freshly prepared, and set it aside for thirty minutes. If arsenic is present in non-permissible amounts, a brownish tint or precipitate will be seen when the tube is placed over a white surface and the solution viewed from above, comparison being made with a mixture of 5 mils of the concentrated hydrochloric acid and 10 mils of concentrated stannous chloride T.S., prepared as directed above.

NOTE: It is absolutely necessary that for this test the solution of stannous chloride be freshly prepared, and that nitrates, sulphates, sulphites, sulphides, and compounds of mercury, gold, and selenium be absent from the reagents, and the chemicals being tested.

3. Test for Heavy Metals

Chemicals.—This test is to be used to detect the presence of undesirable metallic impurities in official chemical substances or their solutions; these must not respond affirmatively within the stated time. Acidulate 10 mils of a solution of the substance in distilled water (1 in 50), contained in a test tube of about 40 mils capacity and of about 2.5 cm. diameter, with 1 mil of diluted hydrochloric acid (unless otherwise directed),* warm it to about 50° C., add an equal volume of freshly prepared hydrogen sulphide T.S., stopper, and allow the mixture to stand at 35° C. for half an hour. At the end of this time the mixture should still possess the odor of hydrogen sulphide; if not, it should be thoroughly saturated with the gas and again set aside for half an hour. The color produced, if any, is not greater than that observed by a blank test made in the same manner and with the same quantities of the reagents (omitting the solution to be tested); the solutions being viewed crosswise by reflected light while held against a white surface. A slight turbidity due to separation of sulphur from the hydrogen sulphide may occur.

Volatile Oils.—Shake 10 mils of the oil with an equal volume of distilled water to which a drop of hydrochloric acid has been added and pass hydrogen sulphide through the mixture until it is saturated; no darkening in color will be produced in either the oil or the water (*lead or copper*).

4. Electrolytic Determinations

Mercury and Zinc.—The electrolytic apparatus consists principally of an ammeter, voltmeter, and rheostat, properly connected with the source of the current, a platinum spiral anode, and a device for rotating the anode.

The source of the current may be either storage batteries or any other system which permits the regulation of the voltage and ampèrage.

Mercury is determined in a mercury cathode cup. It consists of a glass cylinder about 6.5 cm. high and 3.5 cm. in diameter, into which is fused a platinum wire near the bottom, and containing 50–60 Gm. of pure mercury. The platinum wire must be in contact with the mercury.

For the determination of zinc, a nickel dish of about 175 mils capacity is used. A platinum dish upon which a thin layer of silver or copper has been previously deposited may also be used.

Corrosive Mercuric Chloride.—Dissolve 0.3 to 0.4 Gm. of the salt, accurately weighed, in 10 mils of distilled water and transfer the solution to the cathode cup, which has previously been weighed with its metallic mercury. Dilute the liquid to about 20 mils with distilled water, add 1 mil of nitric acid diluted with an equal volume of water and 10 mils of toluol, and pass through the solution a current of 1 to 3 amperes and 8 to 12 volts, stirring the solution by rotating the anode 500 to 600 revolutions per minute. After twenty minutes, when the mercury is all removed from solution (to be ascertained by removing a few drops of the solution and testing with hydrogen sulphide) wash with distilled water, with the aid of a siphon and without interrupting the current until the current drops to nearly zero. Remove the cathode cup, wash the mercury with alcohol, then with ether, remove most of the remaining ether with filter paper, then dry in a desiccator over sulphuric acid and weigh. The increase in the weight in the cathode cup represents the amount of mercury present in the quantity of the salt taken.

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* First neutralize solutions of acids carefully by the addition of ammonia water and then acidify as above directed.

Mercury (Metallic), Mercuric Oxide (Red or Yellow), Mercury with Chalk and Solution of Mercuric Nitrate.—Dissolve an accurately weighed quantity of the substance in nitric acid (1 : 1) (mercury, metallic, or mercuric oxide 0.2 to 0.3 Gm. in 1 mil; mercury with chalk 0.6 to 0.8 Gm. in 2.5 mils; solution of mercuric nitrate 0.5 to 0.7 Gm. with 0.5 mil of nitric acid added), transfer the solution to the cathode cup which has previously been weighed with its metallic mercury, and dilute with distilled water to about 30 mils. Electrolyze the solution as described under *Corrosive Mercuric Chloride,* using a current of 1.5 to 2 amperes and 7 to 10 volts.

Ammoniated Mercury, Calomel, Mercuric Salicylate, Red Mercuric Iodide, Yellow Mercurous Iodide.—Introduce the accurately weighed substance (0.5 to 0.6 Gm. ammoniated mercury or calomel; 0.7 to 0.8 Gm. mercuric salicylate or yellow mercurous iodide; 1.0 to 1.2 Gm. red mercuric iodide) into the cathode cup, previously weighed with its metallic mercury, add 10 mils of solution of sodium sulphide (made by dissolving 50 Gm. crystallized sodium sulphide in sufficient distilled water to measure 100 mils) and dissolve as far as possible by agitation. Dilute the mixture to about 30 mils with distilled water and pass through the solution a current of 2 to 3 amperes and 7 to 10 volts for thirty minutes (or until a few drops of the liquid do not give a black precipitate or coloration when gently warmed with a few drops of concentrated ammonium chloride solution), stirring the solution by rotating the anode about 500 revolutions per minute. Wash the mercury, as described under *Corrosive Mercuric Chloride,* except that before washing with alcohol allow it to stand with about 20 mils of dilute acetic acid (from 2 to 3 per cent.) until bubbles cease to be evolved.

One Gramme of Mercury is the Equivalent of:

	Gramme
Ammoniated Mercury, $HgNH_2Cl$	1.2566
Mercuric Chloride, Corrosive, $HgCl_2$	1.3535
Mercurous Chloride, Mild, HgCl	1.1768
Mercuric Iodide, Red, HgI_2	2.2654
Mercuric Nitrate, $Hg(NO_3)_2$	1.618
Mercuric Oxide (Red or Yellow), HgO	1.0798
Mercurous Iodide, Yellow, HgI	1.6327

Zinc.—Introduce into the weighed dish, an accurately weighed quantity of the salt, equivalent to about 0.15 Gm. of metallic zinc (zinc acetate, 0.5 Gm.; zinc carbonate, 0.25 Gm.; zinc chloride, 0.3 Gm.; zinc oxide, 0.2 Gm.; zinc phenolsulphonate, 1.2 Gm.; zinc sulphate, 0.6 Gm.; zinc valerate, 0.7 Gm.); dissolve it in distilled water or in 10 mils of diluted sulphuric acid (zinc carbonate, zinc oxide), add from 30 to 35 mils of sodium hydroxide solution (20 per cent.) and dilute with distilled water to about 120 mils. Heat the mixture nearly to boiling and electrolyze for thirty minutes with a current of 4 to 5 amperes and 5 to 6 volts, stirring the solution by rotating the anode 500 to 600 revolutions per minute. Without interrupting the current, wash the deposited zinc with distilled water with the aid of a siphon until the current drops to zero or nearly so. Remove the dish, wash the zinc first with alcohol then with ether, dry in a desiccator over sulphuric acid and weigh. The increase in the weight of the dish represents the amount of zinc present in the weight of the salt taken.

To determine zinc in zinc metal, weigh accurately about 1.5 Gm. of the metal, dissolve it by warming with 40 mils of diluted sulphuric acid, filter the solution, if necessary; wash the filter well with distilled water and make up the volume of the solution and washings to 100 mils. Measure 10 mils of this liquid into the weighed dish and proceed as directed above.

One Gramme of Zinc is the Equivalent of:

	Gramme
Zinc Acetate, $Zn(C_2H_3O_2)_2 + 2H_2O$	3.3570
Zinc Chloride, $ZnCl_2$	2.0849
Zinc Oxide, ZnO	1.2448
Zinc Phenolsulphonate, $Zn(C_6H_5SO_4)_2 + 8H_2O$	8.5011
Zinc Sulphate, $ZnSO_4 + 7H_2O$	4.3988
Zinc Valerate, $Zn(C_5H_9O_2)_2 + 2H_2O$	4.6436

5. Assay for Chlorides, Bromides and Iodides

Chlorides.—Dissolve about 0.2 Gm. of the salt to be assayed,* accurately weighed (corresponding to from 30 to 40 mils of tenth-normal silver nitrate V.S.), in 25 mils of distilled water in a 200 mil graduated flask. Add 50 mils of tenth-normal silver nitrate V.S. to the solution, and, after adding 5 mils of nitric acid, add sufficient distilled water to make 200 mils and mix the contents well. Then filter the mixture through a dry filter into a dry flask, and reject the first 20 mils of the filtrate. Add 2 mils of ferric ammonium sulphate T.S. to 100 mils of the subsequent filtrate and then titrate with tenth-normal potassium sulphocyanate V.S., until the supernatant liquid remains reddish after it is well shaken. Multiply the number of mils of tenth-normal potassium sulphocyanate V.S. required by 2 and subtract this figure from the number of mils of tenth-normal silver nitrate V.S. added. The difference, multiplied by the equivalent of the respective chloride (see page 1530) represents the amount of chloride present in the weight of the salt or solution taken.

Bromides and Iodides.—Dissolve about 0.4 Gm. of the salt if a bromide, or 0.5 Gm. of the salt if an iodide,† accurately weighed, in 25 mils of distilled water in a glass-stoppered flask. Add 50 mils of tenth-normal silver nitrate V.S. to the solution, then, after adding 2 mils of ferric ammonium sulphate T.S. and 2 mils of nitric acid, determine the excess of silver nitrate by titrating with tenth-normal potassium sulphocyanate V.S. until the supernatant liquid remains reddish after it is well shaken.

The difference between the number of mils of tenth-normal silver nitrate V.S. added and the number of mils of tenth-normal potassium sulphocyanate V.S. used, multiplied by the equivalent of the respective bromide or iodide being assayed represents the amount of the bromide or iodide present in the weight of the salt taken. This difference, divided by the weight of the salt taken, represents the number of mils of tenth-normal silver nitrate V.S. required by 1 Gm. of the salt.

6. Assay for Alkali Salts of Organic Acids

Heat about 2 Gm. of the salt to be assayed, accurately weighed, in a platinum or porcelain crucible, at first very gently, then gradually raise the temperature until the salt is thoroughly carbonized. (Do not use platinum crucibles for lithium salts.) The final temperature must not exceed a dull red heat and the flame of the burner must not come in contact with the carbonized mass. After allowing the carbonized mass to cool, disintegrate it with the aid of a stout glass rod and transfer the mass and crucible to a beaker. Add 50 mils of distilled water and 50 mils of half-normal sulphuric acid V.S., cover the beaker with a watch glass and boil the contents for thirty minutes. Then filter the solution and wash the residue with hot distilled water until the washings cease to redden blue litmus paper. Now determine the residual acid in the cooled filtrate by titration with half-normal potassium hydroxide V.S., using methyl orange T.S. as indicator. The difference between the number of mils of half-normal sulphuric acid V.S. added and the number of mils of half-normal potassium hydroxide V.S. used, multiplied by the respective equivalent of the salt (see page 1530) represents the amount of salt present in the amount taken.

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* Take 0.4 Gm. of solution of zinc chloride if assayed by this method.

† Take 0.7 Gm. of strontium bromide or strontium iodide.

7. Determination of Ash or Non-volatile Matter

Chemicals.—Weigh accurately from 1 to 2 Gm. of the chemical or the amount directed in the text, and place it in a tared platinum or porcelain crucible. Ignite it, at first very gently, and then gradually raise the temperature until the carbon, if formed, is completely burned off. Conduct the ignition in a place protected from air currents and use as low a temperature as possible to effect the combustion of the carbon. When the carbon has completely disappeared, transfer the crucible while still hot to a desiccator and weigh it when cold. In the case of substances which increase in volume on ignition, or where it is very difficult to burn off the carbon, the determination is facilitated by using a platinum dish of suitable size, or by igniting the weighed quantity of the substance, in the manner described above, in several separate portions.

To test for non-volatile matter in volatile inorganic chemicals proceed as directed above, using as low a temperature as possible.

Vegetable Drugs.—Incinerate 2 Gm. of the ground drug until free from carbon and of constant weight, using a tared crucible and the lowest temperature possible, then determine the weight of the ash. If a carbon-free ash cannot be obtained in this way, exhaust the charred mass with distilled water, collect the insoluble residue on a filter paper of known ash content, incinerate the residue and filter paper until the ash is white or nearly so, then add the filtrate, evaporate it to dryness and heat the whole to a low redness. Finally determine the weight of the ash, deducting the weight of the ash from the filter.

8. Iodine Absorption Value

The iodine value or number of a fat or oil indicates the proportion of iodine absorbed under specified conditions. It is determined as follows: Introduce about 0.8 Gm. of a solid fat or about 0.3 Gm.* of an oil, accurately weighed, into a glass-stoppered bottle of 250 mils capacity, dissolve it in 10 mils of chloroform, add 25 mils of iodo-bromide T.S., accurately measured from a burette or pipette, stopper the bottle securely, and allow the mixture to stand for half an hour † in a cool place protected from light. After this time it must still retain a brown color; if the color is not brown a new test should be started, using a smaller quantity of the fat or oil. Then add in the order named 30 mils of potassium iodide T.S., 100 mils of distilled water, and tenth-normal sodium thiosulphate V.S. in small, successive portions, shaking thoroughly after each addition, until the color of the mixture becomes quite pale. Then add a few drops of starch T.S. and continue the addition of tenth-normal sodium thiosulphate V.S. until the blue color is discharged. While this test is being carried out, make a blank test by mixing exactly the same quantities of iodo-bromide T.S. and chloroform and titrating the free iodine with tenth-normal sodium thiosulphate V.S. as directed above. The difference in the number of mils of tenth-normal sodium thiosulphate V.S. consumed by the blank test and the actual test, multiplied by 1.269 and divided by the weight of the fat or oil taken, gives

9. Saponification Value

The saponification value of a fat or oil is the quantity of potassium hydroxide (expressed in milligrammes) consumed in saponifying 1 Gm. of the fat or oil. It is determined as follows: Weigh accurately, in a flask of 200 to 250 mils capacity, 1.5 to 2 Gm. of the filtered fat or oil and add to it 25 mils of alcoholic potassium hydroxide, accurately measured from a burette or pipette. Insert into the neck of the flask, by means of a perforated stopper, a glass tube from 70 to 80 cm. in length and from 5 to 8 mm. in diameter and heat the flask on a water bath for half an hour, frequently imparting a rotatory motion to the contents. Then add 1 mil of phenolphthalein T.S. and titrate the excess of potassium hydroxide with half-normal hydrochloric acid V.S. Make a blank test at the same time, using exactly the same amount of alcoholic potassium hydroxide V.S. The difference in the number of mils of half-normal hydrochloric acid V.S. consumed in the actual test and the blank, multiplied by 28.055 and divided by the weight of the fat or oil taken, gives the saponification value.

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* 0.15 to 0.18 Gm. for linseed oil, 0.18 to 0.2 Gm. for cod liver oil, and 0.8 to 1.0 Gm. for oil of theobroma.

† One hour is required for castor oil and linseed oil.

10. Acid Number for Resins

The acid number of a resinous substance is the quantity of potassium hydroxide (expressed in milligrammes) required to neutralize 1 Gm. of the resinous substance. Dissolve in alcohol about 2 Gm. of the resinous substance to be tested, accurately weighed, add a few drops of phenolphthalein T.S. and titrate with half-normal potassium hydroxide V.S. The number of mils of half-normal potassium hydroxide V.S. required for neutralization, when multiplied by 28.055 and the product divided by the weight taken, gives the acid number of the resin. The reaction is often more distinct if an excess of half-normal potassium hydroxide V.S. is used and the solution titrated back with half-normal acid V.S.

11. Determination of Crude Fiber

Exhaust a weighed quantity of the ground material, representing about 2 Gm. of the drug, with ether or use the residue from the determination of the volatile extract soluble in ether (see below). Add 200 mils of boiling sulphuric acid solution, adjusted to exactly 1.25 per cent. by titration, to the ether-exhausted drug, in a 500 mil flask and connect the flask with a reflux condenser, the tube of which passes only a short distance below the rubber stopper, into the flask. Heat the mixture to boiling and continue the boiling during thirty minutes. Then filter the mixture through asbestos or glass wool and wash the residue on the filter with boiling distilled water until the washings are no longer acid. Rinse the residue back into the flask with 200 mils of boiling sodium hydroxide solution, adjusted to exactly 1.25 per cent. by titration, and free from sodium carbonate. Again heat the mixture to boiling and continue the boiling during thirty minutes under the reflux condenser as described under the treatment with acid, then rapidly filter through a tared filter, wash the residue with boiling distilled water until the washings are neutral, dry it at 110° C. until of constant weight and note the weight. Now completely incinerate the dried residue and weigh the ash; the loss of weight is considered to be the crude fiber.

12. Determination of Volatile Extractive, Soluble in Ether

Extract completely 2 Gm. of the thoroughly dried and ground drug by subjecting it, during twenty hours, to the action of dehydrated ether in a continuous extraction apparatus. Transfer the ethereal solution to a tared-porcelain dish and allow it to evaporate spontaneously. Then dry it in a desiccator over sulphuric acid during eighteen hours and weigh the total ether extract. Now heat the extract gradually up to 110° C. until the weight becomes constant; the loss in weight during the heating represents the volatile portion of the extract.

13. Determination of Non-volatile Extractive, Soluble in Ether

Proceed as directed under *Determination of Volatile Extractive, Soluble in Ether* (see above). The weight of the extract after drying in a desiccator and then at 110° C. until of constant weight represents the non-volatile portion of the extract.

14. Determination of Alcohol in Official Preparations

Place 25 mils of the preparation, measured at any definite temperature between 15° and 30° C., in a distilling flask of about 200 mils capacity, provided with a high side tube connected with a suitable condenser; add 50 mils of distilled water, distil into a 50 mil graduated flask, at such a rate that about 48 mils of distillate will be received in a half hour; if volatile products other than alcohol are known to be absent, bring to the original temperature and dilute with water of the same temperature to 50 mils.

Determine the specific gravity of the distillate at any definite temperature between 15° and 30° C. by means of a pycnometer and find the per cent. of absolute alcohol by volume by reference to the alcoholometric table (see page 1056), and multiply by the dilution factor to find the per cent. of alcohol in the original preparation.

If the preparation is suspected to contain less than 25 per cent. of alcohol, 50 mils should be taken for analysis; if it is suspected to contain over 50 per cent. of alcohol, 12.5 mils should be taken for analysis. In either case, the volume of the distillate should be made up as usual to 50 mils.

If the preparation contains iodine, combine it with zinc dust. (Sodium thiosulphate may be used instead of zinc dust, in which case several drops of sodium hydroxide T.S. should be added to prevent sulphur from distilling over).

If volatile acids are present, neutralize with sodium hydroxide T.S.; if volatile bases are present, neutralize first with dilute sulphuric acid; if both volatile acids and volatile bases are present, neutralize first with dilute sulphuric acid and distil about 50 mils, neutralize this distillate with sodium hydroxide T.S., and distil once more to obtain in the usual manner 50 mils.

If acetone, camphor, chloroform, ether, glycerin (30 per cent. or over), volatile oils or other volatile products are known or suspected to be present, transfer the first distillate to a separatory funnel and saturate it with sodium chloride, add 15 mils of petroleum benzin (boiling point 40°–50° C.) and shake the mixture for one or two minutes. After the liquids have *completely* separated, draw off the lower alcoholic salt solution, with a second separator, and repeat the extraction with 15 mils of petroleum benzin; draw off the lower alcoholic salt solution into a distilling flask of about 200 mils capacity, wash the combined petroleum benzin solutions with about 25 mils of saturated sodium chloride solution and add the washings to the distilling flask. Distil into a 50 mil graduated flask at such a rate that about 45 to 48 mils of distillate are received within a half hour. Bring to the original temperature, dilute with water of the same temperature to 50 mils, and determine the specific gravity and alcoholic per cent. as directed above.

Alcoholic Content in Preparations

The figures given in the following table represent the average alcoholic content. It is impracticable to require an exact standard in alcoholic liquids made from drugs which contain varying proportions of moisture and extractive, and there is unavoidable loss of alcohol through evaporation during the manufacture and storage of preparations. In addition to this, allowance must be made in distillation for some loss incidental to the process, hence a tolerance of ten per cent. more or ten per cent. less than the figures given in the following table is permitted.

Per Cent. by Volume of Absolute Alcohol

Acidum Sulphuricum Aromaticum	85	Tinctura Belladonnæ Foliorum	47
Elixir Aromaticum	22	Tinctura Benzoini	83
Elixir Glycyrrhizæ	22	Tinctura Benzoini Composita	80
Linimentum Belladonnæ	65	Tinctura Calumbæ	55
Linimentum Chloroformi	47	Tinctura Cannabis	90
Linimentum Saponis	66	Tinctura Cantharidis	90
Mistura Glycyrrhizæ Composita	8	Tinctura Capsici	88
Spiritus Ætheris	66	Tinctura Cardamomi	46
Spiritus Ætheris Nitrosi	92	Tinctura Cardamomi Composita	46
Spiritus Ammoniæ Aromaticus	68	Tinctura Cinchonæ	63
Spiritus Amygdalæ Amaræ	76	Tinctura Cinchonæ Composita	64
Spiritus Anisi	85	Tinctura Cinnamomi	63
Spiritus Aurantii Compositus	69	Tinctura Colchici Seminis	56
Spiritus Camphoræ	90	Tinctura Digitalis	70
Spiritus Chloroformi	89	Tinctura Ferri Chloridi	63
Spiritus Cinnamomi	85	Tinctura Gambir Composita	47
Spiritus Glycerylis Nitratis	94	Tinctura Gelsemii	62
Spiritus Juniperi	90	Tinctura Gentianæ Composita	46
Spiritus Juniperi Compositus	66	Tinctura Guaiaci	80
Spiritus Lavandulæ	90	Tinctura Guaiaci Ammoniata	60
Spiritus Menthæ Piperitæ	85	Tinctura Hydrastis	61
Spiritus Menthæ Viridis	85	Tinctura Hyoscyami	47
Tinctura Aconiti	66	Tinctura Iodi	83
Tinctura Aloes	47	Tinctura Kino	47
Tinctura Arnicæ	46	Tinctura Lactucarii	46
Tinctura Asafœtidæ	81	Tinctura Lavandulæ Composita	70
Tinctura Aurantii Amari	55	Tinctura Limonis Corticis	83
Tinctura Aurantii Dulcis	83	Tinctura Lobeliæ	46

Tinctura Moschi	48	Tinctura Rhei Aromatica	46
Tinctura Myrrhæ	87	Tinctura Sanguinariæ	56
Tinctura Nucis Vomicæ	71	Tinctura Scillæ	69
Tinctura Opii	46	Tinctura Stramonii	45
Tinctura Opii Camphorata	46	Tinctura Strophanthi	92
Tinctura Opii Deodorati	19	Tinctura Tolutana	85
Tinctura Physostigmatis	92	Tinctura Valerianæ	69
Tinctura Pyrethri	90	Tinctura Valerianæ Ammoniata	64
Tinctura Quassiæ	31	Tinctura Veratri Viridis	91
Tinctura Rhei	46	Tinctura Zingiberis	90

15. Proximate Assays

General Directions for Alkaloidal Assays

Nearly all alkaloids are practically insoluble in water, but they are more or less soluble in alcohol, chloroform, ether, amyl alcohol, benzene, petroleum benzin, or mixtures of several of these. The salts of the alkaloids, however, are mostly soluble in water, but practically insoluble in nearly all of the above mentioned solvents. The process of assay by immiscible solvents, which is generally known as the "shaking out" process, is based on this property of alkaloids, and it is carried out by treating the drug or a concentrated liquid extract with a solvent immiscible with water, in the presence of an excess of alkali, which liberates the alkaloid. The free alkaloid is dissolved by the immiscible solvent, which is then transferred to a separator and shaken with an excess of acid diluted with water.

When a drug to be assayed is directed to be made from a powder of a certain degree of fineness it is understood to mean that it must not be coarser than the size directed; a finer powder may, however, be used.

If the immiscible solvent is specifically heavier than water (*e.g.*, chloroform or a mixture of more than one volume of chloroform to one volume of ether) it will separate in the bottom of the separator. It is then drawn off into another separator and shaken with successive portions of weak acid until the alkaloid is all removed.

If the immiscible solvent is specifically lighter than water (*e.g.*, ether, or a mixture of more than two volumes of ether with one volume of chloroform) it will, on separation, form the upper liquid. The lower acid liquid is then drawn off and preserved, and the residual immiscible solvent shaken with successive portions of weak acid until wholly free from alkaloid.

The volume and strength of the acid to be used is left to the discretion of the operator. It is best, however, to keep the total volume as small as possible. For the first extraction, it is advisable to use 10 mils of half-normal acid V.S. or sufficient to render the mixture distinctly acid; for the second extraction, use 5 mils of half-normal acid V.S. and 5 mils of distilled water. Repeat the extraction with the same proportion of acid and distilled water. In all assays, the extraction should be continued until 0.5 mil of the acid washings shows only a very faint cloudiness on the addition of a drop of mercuric-potassium iodide T.S., or, in the case of caffeine and colchicine, on the addition of a drop of iodine T.S.

The united acid solutions containing the alkaloid in the form of a salt are shaken thoroughly with ether and allowed to stand at least fifteen minutes for complete separation. The acid solution is then drawn off into a second separator, the ether washed with a little water and this wash water added to the acid solution. The acid solution is then made alkaline, in most cases with ammonia water, and shaken out with several successive portions of the appropriate immiscible solvent. The volume of the latter to be used in each operation is not less than half that of the acid solution, and the operation must be repeated as long as any alkaloid is extracted by the immiscible solvent. To test this, evaporate 1 mil of the last extraction and dissolve the residue in a few drops of diluted hydrochloric acid; the resulting solution should show not more than a very faint cloudiness on the addition of a drop of mercuric-potassium iodide T.S., or, in the case of caffeine and colchicine, on the addition of a drop of iodine T.S. The number of extractions required depends largely on the character of the alkaloid. With most alkaloids it is advisable to

" shake out " three or four times before testing. Physostigmine and pilocarpine require about twice as many extractions as most other alkaloids.

After having drawn off from a separator any liquid containing an alkaloid, a fresh portion of the solvent should be immediately added to the contents of the separator, and, before shaking, about 1 mil of this should be drawn off to wash out the stem of the separator. In the case of volatile solvents, the outside of the stem of the separator should also be washed by dipping it in the portion of the fresh solvent to be used for the next shaking out operation. Before evaporation the final ether or chloroform solution should be filtered through a dry filter, or preferably through a pledget of purified cotton. When filtering volatile solvents containing alkaloids through a paper filter, the upper edge of the filter should not reach the top of the funnel and the filter should be kept constantly full of the liquid until all has been added, then covered until the last of the liquid has passed through. Finally the filter should be washed thoroughly by applying portions of the volatile solvent to the top and carefully washing the outside of the funnel stem. Immiscible solvents heavier than water may be conveniently filtered by packing the stem of the separator below the stop-cock with purified cotton before drawing off the solvent. The alkaloidal solution is finally evaporated cautiously to expel the solvent, and the residue either dried to constant weight and weighed, or more commonly titrated with volumetric acid.

When using aliquot parts, the solvent and the aliquot part should be measured at the same temperature. When pouring volatile liquids, the lower the temperature at which the operation can be conducted, the less the danger of loss from evaporation.

The shaking or rotation with an immiscible solvent should ordinarily be continued about one minute. Long or violent agitation should be avoided as emulsions are apt to form. Should a partial emulsion form it may be broken up by drawing off the clear portion, introducing a tuft of cotton and with a glass rod moving the cotton about in the emulsion next to the surface of the separator. Should the emulsion prove persistent, draw off the emulsified portion and evaporate the volatile solvent. The resulting residue, if alkaline, should be washed with each successive portion of the solvent used in extracting the original solution. If acid, it should be washed with acidulated water.

Emulsions are less apt to form in strongly acid or alkaline solutions than in those which are neutral or slightly acid or alkaline. Emulsification is sometimes prevented by increasing the volume of the aqueous or of the immiscible solvent. Chloroform or ether solutions of drugs rich in fat form very troublesome emulsions. In such cases it is advisable to add about 10 mils of normal sulphuric acid V.S., and evaporate the volatile solvent, stirring with a rubber-tipped glass rod. When the resinous and fatty matter has been agglutinated, cool the acid solution and filter it through a small wetted filter into a separator. Redissolve the residue in 15 mils of ether, add 5 mils of tenth-normal acid V.S., evaporate the ether as before, with continued stirring, and pour the acid solution through the filter into the separator. Repeat the extraction of the fatty residue with dilute acid two or three times and finally wash the filter free from alkaloids. Then make the solution in the separator alkaline, and " shake out " with the immiscible solvents in the usual manner.

The stems of separators and funnels and the lips of flasks, separators and graduates, from which volatile solvents containing alkaloids have been poured or drawn off, should be carefully washed to prevent loss and to remove any of the alkaloids left by evaporation, and the washings should be added to the solvent.

An alkaloidal residue to be determined volumetrically should be softened by the addition of about 1 mil of neutral alcohol or ether, the required amount of standard acid added, and the mixture gently warmed to insure the complete solution of the alkaloid. Finally add a sufficient quantity of distilled water to make the volume of the liquid for titration measure about 25 mils. When the residue is to be weighed, if the final solvent has been chloroform, the last traces of that solvent should be removed by the addition of a little ether or alcohol followed by evaporation; care being taken to avoid loss by decrepitation, especially when evaporating a chloroformic solution of nux vomica or of cinchona alkaloids. This may usually be prevented by the addition of a little alcohol after the solution has been reduced to a volume of one or two mils.

If preferred, methyl red T.S. may be used in place of cochineal T.S. for alkaloidal titration, in which case the volumetric solution should have been standardized by the use of methyl red T.S. If this has not been done a blank titration should be made to determine the factor for the tenth-normal sulphuric acid V.S., using methyl red T.S. as the indicator.

16. Melting Points (see page 130)

17. Boiling Points (see page 148)

18. Congealing Points (see page 133)

19. Solubilities (see page 214)

20. Gasometric Estimations

In certain cases the Pharmacopœia directs the strength of a product or chemical substance to be determined by the volume of gas (nitrogen dioxide) given off during a definite reaction. This volume is to be determined by the use of the nitrometer in the following manner:

Arrange a nitrometer consisting of a measuring tube (graduated into one-tenth milliliter divisions and having a capacity of at least 50 mils) connected by stout rubber tubing with an open equilibrium tube (both tubes, preferably, provided with a globular expansion near the lower end) in such a manner, by suitable clamps attached to a stand, that either tube may be readily and quickly clamped at a higher or lower level. The stop-cock of the measuring tube having been opened, and the open equilibrium tube having been raised to a higher level, pour into the latter a saturated aqueous solution of sodium chloride, until the measuring tube, including the bore of the stop-cock, is completely filled. Then close the latter and adjust the equilibrium tube at a low level. Having ascertained that the stop-cock is closed and is air-tight, and having, if necessary, wiped out the graduated tube of the nitrometer, introduce into it the prescribed quantity of the liquid to be tested, and allow this to flow slowly into the measuring tube, being careful not to admit any air. Follow it by the prescribed quantities of the several reagents (potassium iodide T.S. and normal sulphuric acid V.S.). When the reaction (which takes place at once) moderates, remove the measuring tube from its clamp, and, being careful to hold it constantly so that the liquid contained in it stands at a higher level than that in the equilibrium tube, shake its contents, without permitting any gas to pass into the open tube. When the reaction has completely ceased and the volume of gas has become constant, which usually requires from thirty to sixty minutes, restore the tube to its fastening, and allow the apparatus and contents to acquire the ordinary temperature of the room, which is assumed to be at or about 25° C. Then adjust the two tubes so that the liquid columns are at exactly the same level, and read off the volume of gas in the measuring tube. Multiply this figure by the weight of the liquid being assayed which is the equivalent of 1 mil of nitrogen dioxide (see page 1550). The result will be the weight of the absolute substance (ethyl, amyl, or sodium nitrite) contained in the quantity taken for the assay.

For pharmacopœial purposes the determination will be sufficiently exact if the evolved gas be measured within 3 degrees above or below 25° C.

Since temperature and barometric pressure affect the volume of the gas, the following correction factors must be used to obtain exact results when the temperature and pressure are not nearly normal. The barometer correction is important at any locality more than 250 meters above sea-level:

FACTORS FOR TEMPERATURE CORRECTIONS
(Normal Temperature, 25° C.)

Temperature	Factor	Temperature	Factor	Temperature	Factor
15° C.	1.035	22° C.	1.010	29° C.	0.987
16° C.	1.031	23° C.	1.007	30° C.	0.983
17° C.	1.028	24° C.	1.003	31° C.	0.980
18° C.	1.024	25° C.	1.000	32° C.	0.977
19° C.	1.021	26° C.	0.997	33° C.	0.974
20° C.	1.017	27° C.	0.993	34° C.	0.971
21° C.	1.014	28° C.	0.990	35° C.	0.968

Example: Assuming that the volume of gas read off was 44.5 mils at 32° C., and it is desired to ascertain the corresponding volume at 25° C., barometric pressure not being taken into consideration, then the 44.5 mils must be reduced in the proportion of 1 to 0.977 (see temperature correction factors above), or 44.5 must be multiplied by 0.977. The result will be 43.48 (more exactly 43.4765) mils as the equivalent volume of gas at 25° C.

FACTORS FOR CORRECTION FOR BAROMETRIC PRESSURE

(Normal Barometer, 760 mm.)

Barometer Reading		Factor	Barometer Reading		Factor
Millimeters	Inches		Millimeters	Inches	
790	31.10	1.039	660	25.98	0.868
780	30.71	1.026	650	25.59	0.855
770	30.31	1.013	640	25.20	0.842
760	29.92	1.000	630	24.80	0.829
750	29.53	0.987	620	24.41	0.816
740	29.13	0.974	610	24.02	0.803
730	28.74	0.961	600	23.62	0.789
720	28.35	0.947	590	23.23	0.776
710	27.95	0.934	580	22.83	0.763
700	27.56	0.921	570	22.44	0.750
690	27.17	0.908	560	22.05	0.737
680	26.77	0.895	550	21.65	0.724
670	26.38	0.882	540	21.26	0.711

Example: Assuming that the volume of gas read off was 43.48 mils at 590 mm. barometric pressure, and it is desired to ascertain the corresponding volume at normal barometric pressure (760 mm.), temperature not being taken into consideration, then the 43.48 mils must be reduced in the proportion of 1 to 0.776 (see barometric correction factors above), or 43.48 must be multiplied by 0.776. The result will be 33.74 mils as the equivalent volume of gas at normal barometric pressure.

ESTIMATION OF NITROGEN DIOXIDE

$$\mathrm{NO} = 30.01;\ 1\ \text{Liter} \begin{cases} \text{at } 0^\circ\ \text{C. and 760 mm.} = 1.3406\ \text{Gm.} \\ \text{at } 25^\circ\ \text{C. and 760 mm.} = 1.2281\ \text{Gm.} \end{cases}$$

One Milliliter of Nitrogen Dioxide is the equivalent of:

		At 0° C. and 760 mm. Gramme.	At 25° C. and 760 mm. Gramme.
Nitrogen Dioxide, NO	= 30.01	0.0013406	0.0012281
Amyl Nitrite, $C_5H_{11}NO_2$	= 117.10	0.0052310	0.0047920
Ethyl Nitrite, $C_2H_5NO_2$	= 75.05	0.0033528	0.00307127
Sodium Nitrite, $NaNO_2$	= 69.01	0.0030828	0.0028241

21. Optical Rotation

In a ray of ordinary light the transverse vibrations take place indifferently in any plane about the line of propagation. When these waves are limited to a single plane they are termed polarized and the phenomenon is known as polarization.

Many organic substances either liquid or in solution in suitable solvents, when examined in a specially constructed optical apparatus called a polariscope, are capable of rotating the plane of polarization of a ray of light either to the right or to the left. Such substances are termed "optically active," and when rotating to the right are designated as "dextrorotatory," and when rotating to the left as "lævorotatory." Substances which do not possess this property of optical rotation are termed "optically inactive." Optical activity in many instances is intimately connected with the chemical constitution of a substance, and it frequently becomes a specific property and its determination is of considerable value.

Among the substances recognized by the Pharmacopœia, there are several, particularly certain essential or volatile oils and related bodies, for which the determination of the angle of rotation of a ray of polarized light, or, in some cases, the proof of their optical inactivity, affords the most simple and positive evidence of their identity or purity.

The instruments used for this purpose vary somewhat in their construction and are classified as polarimeters measuring angular rotation and saccharimeters measuring percentage of sugar. Those which are most generally adapted for the examination of the substances mentioned above are the penumbral or so-called "half-shadow" instruments of Laurent and of Schmidt and Hänsch in which the two sides of the field of vision are capable of becoming unequally illuminated. Polarimeters permit the angle of rotation to be read off in degrees or fractions of a degree of a circle. Saccharimeters, set to measure percentage of sucrose, give readings in terms of divisions of the sugar scale.

These determinations are best made in a dark room, and by means of monochromatic light, the latter being obtained by introducing into a non-luminous flame, on a loop of platinum wire, a small bead of fused sodium chloride. The light thus radiated corresponds with the line D of the solar spectrum.

The following factors are employed for converting readings of a saccharimeter into readings of a polarimeter.

1 division Laurent sugar scale equals 0.2167° angular rotation D.

1 division Schmidt and Hänsch sugar scale equals 0.346° angular rotation D.

Since the deviation of the plane of polarization either to the right or to the left of the zero point is directly proportional to the length of the column of liquid, it is important that the observations should be made with tubes of a definite length, such as 200, 100, 50, or 25 mm. The selection of the length of the tube to be employed is, however, usually dependent upon the depth of color of the liquid and the magnitude of its optical rotation.

The rotatory power of an optically active, liquid substance, observed with sodium light, and referred to the ideal density 1, and in a tube having a length of 1 decimeter (100 mm.), is designated as its *specific rotatory power*. This is usually expressed by the term $[a]_D$. Since, however, not only the density of an optically active liquid, but also its rotation, is influenced by the temperature, the specific rotation varies with the latter. In stating the specific rotation it is, therefore, necessary to indicate at what temperature the rotation and the density of the liquid have been determined. But for the same temperature the specific rotation of a pure, optically active liquid is always a constant number. The temperature used in the text of this Pharmacopœia is 25° C., except when otherwise indicated. For saccharimeters the temperature is fixed at 20° C. by international agreement.

For calculating the specific rotatory power of an optically active liquid substance, or solution of an optically active solid, the following formulas are of general application:

I. For liquid substances $[a]_D = \frac{100 \times a}{L \times d}$

II. For solution of solids $\left\{ \begin{array}{l} [a]_D = \frac{10000 \times a}{L \times p \times d} \\ \text{or} \quad [a]_D = \frac{10000 \times a}{L \times c} \end{array} \right.$

For calculating these formulas the determination of the following factors is necessary:

a = the angle of rotation of the liquid or solid observed with sodium light.
L = the length of the tube in millimeters.
d = the density of the active liquid or solution.
p = the amount of active substance in 100 parts by weight of the solution.
c = the number of grammes of active substance in 100 mils of solution.

22. Refractive Index

When a ray of light passes from one transparent substance to another, it is deflected, except when it enters perpendicularly to the surface of contact. The direction of the deviation is dependent upon the difference of density of the two substances; the extent is also influenced by this difference.

This deviation is termed refraction. When the ray passes from a substance of given density to one of greater density (*i.e.*, from air into glass) the refraction is towards the perpendicular meeting the surface at the point of contact; when passing from a substance of greater density to one of less (*i.e.*, from water into air) the ray deviates from the perpendicular at the point of contact.

Quantitative measurements of refraction are expressed as "indices of refraction," the index being the figure obtained by dividing the sine of the angle that the incident ray makes with the perpendicular, by the sine of the angle that the refracted ray makes with the same perpendicular; that is, it is the ratio between these sines. Thus, the ratio for a ray of light passing from air into water at standard temperature is about 4 : 3 or, expressing it decimally and with greater exactness, 1.336. This is, therefore, the index of refraction of water. The determination of the refractive index is accomplished by means of optical instruments known generally as *refractometers*, which are of several types. Some of these give figures on an arbitrary scale, the actual refractive index being ascertained by consulting a table.

As the exact temperature at which the examination is made is of great importance, all of the instruments are provided with attachments for circulating water of the proper temperature about the prisms or about the vessel containing the liquid to be observed, and are also equipped with thermometers for observing the temperature very closely.

The principal instruments in use are as follows:

Pulfrich Refractometer.—This instrument is used chiefly for purely scientific investigations. It is adapted for use with liquids and solids of all degrees of refractive power. When a liquid is to be examined it is placed in a small cylindrical glass vessel immediately above the observation prism. When solids are to be examined the glass cylinder is removed and the solid (previously polished) is placed in direct contact with the observation prism. The reading of this instrument is made by noting a boundary line between a light and a dark field in its position with reference to a graduated scale upon which the refractive index is directly expressed.

The Abbe Refractometer.—This is an instrument of wide utility, designed primarily for the examination of liquids. Only a few drops of the liquid are required for an observation. This is spread in a thin film between the two observation prisms. The index of refraction is also read off directly upon the scale of this instrument, in which, as in the Pulfrich Refractometer, a boundary line between a light and a dark field is the observation line.

The Zeiss Butyro-Refractometer.—This instrument is especially designed for the examination of fixed oils and fats. It is not applicable to aqueous or alcoholic liquids. The distinctive line for observation in this instrument is the border line of total reflection, which is a narrow line capable, usually, of being accurately read to within a tenth of a unit of the arbitrary scale used. Sometimes this observation line is accompanied by a blue or a red fringe or haze which interferes with the accuracy of the reading. Should a close reading be impossible on this account, it will be found necessary to use the monochromatic sodium flame for the observation (see under optical rotation).

Zeiss Immersion Refractometer.—This is adapted for the examination of aqueous, oily, or alcoholic liquids. The distinctive line for observation is as described under the preceding instrument, the border line of total reflection, which in this case is much sharper and capable of being much more accurately read. For making observations of the entire range of Pharmacopœial substances the Abbe instrument is the one generally selected, the Pulfrich instrument not being in common use and the Zeiss Butyro- and Immersion Refractometers not covering the entire range necessary.

23. Biological Assays

Inasmuch as there are several drugs more or less extensively used in the treatment of disease, for which no satisfactory chemical method of assay has been developed, other assays have been introduced in which these drugs are administered to animals and the effects noted. From the results obtained from these assays the strength of the preparation is calculated, and, if necessary, proper corrections are made so that the preparation shall conform to the standard which has been adopted. The official drugs to which these methods of assay have been applied in the following pages, are the members of the digitalis group, cannabis, and aconite, and the suprarenal gland.

Brief descriptions of the more commonly accepted methods are given here in order, first, to direct the attention of manufacturers to them; second, to ascertain the points of weakness which may exist in them; and, finally, to outline methods and establish standards which those interested may adopt should they desire to assay their products and have them conform to the standards proposed. All preparations thus assayed and made to conform to these standards may be labeled "Physiologically Assayed and Standardized According to the U. S. P. IX."

In the case of Cannabis and its preparations, the biological assay standards are compulsory.

CANNABIS

The assay of Cannabis and its preparations has been made a requirement and is based upon the fact that this drug produces certain symptoms of muscular incoördination. The method consists of ascertaining the dose of the preparation to be tested which will produce these symptoms of incoördination in dogs and then adjusting its strength by comparison with a standard preparation.

Dogs.—The animals differ considerably in susceptibility to the drug and therefore it is best to make preliminary tests upon several dogs with average-sized doses and select from among them the animals which react easily to the drug. As a rule, fox terriers serve very well for the purpose, but any dog may prove satisfactory. It is best to provide at least two dogs for each assay, but if many samples are to be examined more dogs will be needed. The dogs should be at least one year old and in normal health and must be kept under the best sanitary conditions. They may be used repeatedly for the purpose but not at shorter intervals than three days. Each series of tests should be conducted by the same person who should be perfectly familiar with the peculiarities of each animal in order that he may recognize more certainly deviations from the normal. While the tests are being made the animals should be kept in a perfectly quiet room, free from disturbance and separated so that they cannot see each other.

Preparation of the Drug.—The drug may be given most conveniently in the form of the fluidextract which is administered in gelatin capsules, or the extract made into soft pills may be used; but whichever form is chosen the same should be used for both the standard and the preparation that is to be tested.

Before administration the animal should not be fed for twenty-four hours in order to hasten absorption. The head of the animal being held, its mouth is opened and the capsule or pill is placed upon the back of the tongue. Usually the drug is easily swallowed when given in this way, but this may be facilitated by giving the animal a small amount of water to drink.

Assay.—An average dose of the known or standard preparation is given to one of the dogs and a like dose of the preparation to be standardized is given the second dog. After one hour both dogs are observed very carefully for symptoms of muscular incoördination. The incoördination is manifested differently in different animals, but in small doses it shows itself most frequently in slight swaying, when the animal is standing quietly, or in some ataxia when it runs about. The observation should be made frequently during the second hour following the administration of the drug.

The results obtained from the first test should be confirmed after an interval of not less than three days by repeating the administration but reversing the order, that is, giving the known strength drug to the dog which received that of unknown strength before and *vice versa*.

In subsequent tests which are carried out, the dose of the preparation of unknown strength is modified so as to produce similar symptoms to those produced by the standard. If the preparation to be tested is below the standard in strength, its dose must be increased, or if it is above strength its dose is lessened until equivalent doses of the two are found. Dogs may be used over long periods of time, even for some years, but occasionally they have to be discarded, as in some cases they seem to learn the effects of the drug and so refuse to stand up. A certain degree of tolerance is sometimes gained which necessitates larger doses.

Standard.—As there is no chemical substance of definite composition which can be adopted as a standard, a Fluidextract of Cannabis, or an extract which has been carefully prepared and suitably preserved, may be utilized for this purpose. A standard Fluidextract will produce incoördination when administered to dogs in the dose of 0.03 mil for each kilogramme of body weight of dog. When administered in the form of the Extract, a dose of 0.004 Gm. for each kilogramme of body weight of dog should produce similar symptoms, and the requirement for a standard tincture is a dose of 0.3 mil for each kilogramme of body weight of dog.

ACONITE

The method for the physiological assay of Aconite depends upon the determination of the minimum lethal dose for guinea-pigs.

Method.—The guinea-pigs to be utilized should be of average size and not too large; preferably from 250 to 350 Gm. in weight and in a healthy condition.

The drug may be administered in the form of fluidextract, extract, or tincture, which in the preliminary trial may be injected subcutaneously into a series of guinea-pigs in doses having sufficiently wide limits. If the extract is to be standardized, it must be dissolved in sufficient solvent to produce a liquid preparation before injection. The animals after injection are placed in cages and at the end of the observation (twelve hours), note is taken of those living and dead.

After this preliminary test, the limits of the doses for a second series of animals are further narrowed and, if necessary to still further confirm the earlier results, additional series may be injected until the minimum lethal dose for the guinea-pig is found.

Standard.—A satisfactory preparation of the Fluidextract of Aconite should kill guinea-pigs when administered in doses of 0.00004 mil for each gramme of body weight of guinea-pig; a satisfactory Tincture of Aconite should prove fatal to guinea-pigs when given in doses of 0.0004 mil for each gramme of body weight of guinea-pig and a satisfactory Extract of Aconite should have a minimum lethal dose not greater than 0.00001 Gm. for each gramme of body weight of guinea-pig.

DIGITALIS—STROPHANTHUS—SQUILL

For the members of the digitalis series the so-called "one hour frog" method is recommended. This method consists essentially in ascertaining the dose of a drug or preparation which will bring the heart of a standard sized frog to systolic standstill in one hour's time. The method is carried out as described below; all measurements being performed with the same degree of accuracy used in ordinary quantitative chemical estimations.

Frogs.—The frogs to be employed in an assay should be in a healthy condition and of the same species. Those most commonly obtainable in this country are the common grass frogs (*Rana viridis* or *Rana pipiens*). While the dose for a frog is estimated according to its weight, it is best to use frogs of a fairly uniform size, the most convenient weight for such work being between 15 and 25 Gm.

Storage.—Before use the frogs should be stored in tanks kept in a cool room, preferably where the temperature does not rise above 15° C. The bottom of the tanks should be covered with running water or, if running water is not convenient, standing water may be used if it is changed from two to four times daily. An hour before the frogs are to be used for an assay a sufficient number should be taken to the operating room, each one carefully weighed to within 0.1 Gm. and placed in an individual wire cage or container, these are then placed in a tank containing water to the depth of about 1 cm. (½ inch) which is kept during the process of assay at a uniform temperature of 20° C. The maintaining of a uniform temperature at which all assays of the members of this group should be carried out is important, as the susceptibility of frogs differs very considerably at different temperatures.

Dosage.—After the frogs have been weighed as described, the doses to be given are calculated according to their weights and are measured into small conical glasses by means of a finely graduated pipette. The doses of the preparation which are to be injected should be as uniform in quantity as possible and should not exceed 0.015 mil for each gramme of body weight of frog. The members of the digitalis series may be assayed in either fluidextract or tincture strength, being diluted with water as may be necessary to get the volume dose. In case the alcohol content in any preparation after dilution is higher than 20 per cent., the preparation may be subjected to careful evaporation and subsequent dilution with an aqueous solution containing 0.7 per cent. of sodium chloride until the original volume is restored and the alcohol content is not above the per cent. named. It is always best to have the alcohol content of different preparations uniform. In case there is a precipitate, the preparation to be assayed should be shaken each time a dose is measured out.

When the doses are ready, they may be injected into the anterior lymph sac of the animal. This is done by means of a glass pipette which is drawn out to a fine point. The frog is held on its back in one hand and the pipette with the contained drug in the other, the mouth of the frog is opened with the point of the pipette and, carefully avoiding the tongue, the floor of the mouth is punctured and the point of the pipette is then seen to enter the anterior lymph sac of the frog. The contents of the pipette are now forced into the sac either by gravity or by gently blowing, if necessary. In the latter case, care should be taken not to introduce air into the sac. Care should also be taken not to puncture the skin. The animal is then replaced in its cage in the tank, the temperature of which is maintained as stated at 20° C.

At the end of one hour from the time of injection each frog is pithed, both brain and cord, the heart is exposed and its condition examined. For the correct end reaction the ventricle should be in systolic standstill while the auricles should be widely dilated.

Following mechanical stimulation feeble contractions may be allowed in the auricles and localized contractions in the ventricle, but no general contraction is allowable.

If when the heart of an animal is being exposed for examination, remains of the injected drug are found in the lymph sac unabsorbed, such an animal should be discarded and not considered in the results obtained.

It happens sometimes that one frog out of a large series may prove a decided exception to the others in the way of increased or decreased susceptibility to the drug. Such an animal should also be discarded.

After the primary or trial assay has been carried out and the approximate strength of the preparation ascertained, a second series of frogs are injected in like manner, using doses the limits of which are considerably narrower than the first series. A third or even fourth series of injections may be necessary to confirm the earlier results. The dose thus found is then compared with the dose of a standard which is similarly ascertained upon another series of frogs of the same lot. From such a comparison the strength of the unknown preparation can be suitably adjusted.

The use of a standard is made necessary by the fact that frogs differ in their susceptibility to the members of the digitalis series at different seasons of the year. The condition of susceptibility is ascertained and allowed for by the use of a solution of ouabain (see page 1506) as a standard which in appropriate doses is injected into a series of frogs and their resistance thus determined. The necessary strength of an unknown preparation may be calculated from the dose actually found by the ratio of the standard dose of ouabain to the dose of ouabain found neocessary to kill. Thus:

Standard dose of ouabain	:	Found dose of ouabain	: :	Standard dose of drug being assayed	:	Necessary dose of unknown

The standard dose of ouabain is 0.0000005 Gm. per gramme of body weight of frog.

The standard dose of Tincture of Digitalis to correspond is 0.006 mil per gramme of body weight of frog.

If, therefore, in a certain series of frogs the resistance to ouabain is found to be increased so that a dose of 0.00000075 Gm. is necessary to stop the heart in systole in one hour, the dose of Tincture of Digitalis would also have to be increased to 0.009 mil, and the actual dose found calculated against this, instead of against the standard dose of 0.006 mil. For example, in frogs showing the increased resistance as indicated above, if the Tincture being examined assays 0.018 mil per gramme of body weight it is one-half strength.

Standards.—The standards adopted are as follows:

	Gramme or mil for each gramme of body weight of frog.
Standard dose of ouabain	0.0000005
Digitalis	
Leaves (in the form of tincture)	0.0006
Fluidextract	0.0006
Tincture	0.006
Strophanthus	
Seed (in the form of tincture)	0.000006
Tincture	0.00006
Squill	
Dried Squill (in the form of tincture)	0.0006
Fluidextract	0.0006
Tincture	0.006

SUPRARENAL GLAND

The assay of products of the Suprarenal Gland is carried out by means of a comparison of the rise in blood-pressure produced in a dog by an injection of an aqueous preparation of the gland with that produced by a solution of known strength of lævo-methylamino-ethanol-catechol ($C_9H_{13}NO_3$) (see page 1502).

Standard Solution.—Prepare an aqueous solution of lævo-methylamino-ethanol-catechol (1 in 1000), using sufficient diluted hydrochloric acid, and from this solution prepare a second solution of the strength of 1 in 100,000 by adding 1 mil of the original solution (1 in 1000) to 99 mils of physiological solution of sodium chloride; this latter solution should be freshly prepared for each assay.

Prepare a solution by adding 1 Gm. of the finely powdered dried suprarenal glands to be tested to 100 mils of distilled water containing 10 mils of diluted hydrochloric acid, allow this mixture to macerate during twenty-four hours, shaking it frequently during that time, and then filter through a dry filter. It is then ready for use.

Dogs.—The animal, which should be of medium size, is anesthetized with a suitable anesthetic. The animal is prepared for blood-pressure estimations in the usual manner by the insertion of a suitable cannula into one carotid artery and this in turn is connected with an ordinary mercury manometer. The trachea is exposed and a cannula inserted into it so that the animal may receive artificial respiration during the course of the experiment.

The femoral vein on each side is exposed and a cannula inserted in each. These should be fitted with short pieces of small rubber tubing to serve as connections for the injecting syringes.

Two glass syringes graduated to 0.05 mil should be provided, one to be used for injecting the standard and the other for the aqueous preparation of the gland.

Before the test is made, in case any muscular movement such as twitching is present, the dog should receive by intravenous injection, a sufficient dose of curare (see page 1497), but if the animal is deeply anesthetized, this may not be necessary. The dog should also receive a sufficient dose of atropine sulphate (0.001 to 0.002 Gm.) to paralyze the vagi, this paralysis being proved by electrical stimulation.

The blood-pressure tracing may be best taken on a long kymograph, which may be allowed to run from the time of injection until after the crest of the pressure rise has been passed, when it may be stopped.

Injections should be made at regular intervals and these intervals should not be shorter than five minutes.

One cannula and one syringe are now filled with the standard solution prepared as directed above and 1 mil is injected. The rise of blood-pressure should be submaximal, say from 30 to 60 mm., and in case this figure is much exceeded a second injection of 0.5 mil may be made five minutes later. After a satisfactory dose has been ascertained, 1 mil of the aqueous preparation of the gland may be injected with the second syringe into the femoral vein of the opposite side. In subsequent injections this dose may be increased or decreased as necessary until such an amount is found as will give the same elevation of blood-pressure as the establised dose of the standard solution when the two solutions are given in alternating doses. When this relation has been ascertained, it should be confirmed on the same animal by making the injection into the opposite sides from which they have been made in the earlier tests. Before these confirmatory tests are made, it is necessary to wash out the cannulas most carefully before the new solutions are introduced.

The ratio of activity found between these two solutions may be confirmed by injections made into a second animal, using a new aqueous extract of the gland prepared in the same manner as the first.

From the results thus obtained, the strength of the aqueous preparation of the gland may be determined by calculation and expressed in terms which indicate its relative activity as compared with that of the standard.

Standard.—One gramme of *Suprarenalum Siccum* contains the equivalent of 10 milligrammes of lævo-methylamino-ethanol-catechol.

Diagnostical Reagents and Clinical Tests

In the following pages of Diagnostical Reagents and Clinical Tests it is understood that the standard for official substances like Iodine, Potassium Iodide, Gelatin, Sodium Chloride, etc., are those to be found in the text of the Pharmacopœia or among the reagents. If the solutions are not clear, filter them.

Reagents for Examination of Urine

For Acetone Reaction

Sodium Nitroprusside (see page 1512), used for Legal's test and Lange's test).

Iodine Potassium Iodide Solution (for Lieben's solution):

Potassium Iodide	6 Gm.
Iodine	4 Gm.
Distilled Water, a sufficient quantity,	
To make	100 mils

Dissolve the potassium iodide in the distilled water, add the iodine and shake the mixture frequently until a solution is obtained.

Alcoholic Solution of Iodine (10 per cent.), for Gunning's reaction. To be freshly prepared.

For Albumin Reaction

Glacial Acetic Acid (official).

Acetic Acid (official).

Potassium Ferrocyanide (see page 1509).

Nitric Acid (official).

Saturated Aqueous Solution of Trinitrophenol (official).

Esbach's Reagent:

Trinitrophenol	1 Gm.
Citric Acid	2 Gm.
Distilled Water, a sufficient quantity,	
To make a solution measuring	100 mils

Spiegler-Jolles' Reagent:

Corrosive Mercuric Chloride	2 Gm.
Succinic Acid	4 Gm.
Sodium Chloride	4 Gm.
Distilled Water, a sufficient quantity,	
To make	100 mils

Mix the several ingredients and dissolve them in the distilled water.

Trichloracetic Acid (official).

For Albumose Reaction

Phosphotungstic Acid (see page 1507) (Salkowski's test).

For Bile Reactions

UROBILIN

Amyl Alcohol (see page 1492).

Solution of Zinc Chloride (about 10 per cent.):

Zinc Chloride	10 Gm.
Distilled Water, a sufficient quantity,	
To make a solution measuring	100 mils

Mixture of Zinc Acetate:

Zinc Acetate	10 Gm.
Dehydrated Alcohol, a sufficient quantity,	
To make	100 mils

Finely powder the zinc acetate and intimately mix it with the alcohol. Dispense the mixture with directions "to be well shaken before using."

UROBILINOGEN

Ehrlich's Solution:

Paradimethylamidobenzaldehyde	2 Gm.
Hydrochloric Acid	50 mils
Distilled Water, a sufficient quantity,	
To make a solution measuring	100 mils

BILIARY COLOR REACTIONS

Nitric Acid (containing a trace of nitrous acid).

Solution of Calcium Chloride (about 10 per cent.) (Hupert's reaction):

Calcium Chloride	10 Gm.
Distilled Water, a sufficient quantity,	
To make a solution measuring	100 mils

Alcoholic Solution of Iodine (about 1 per cent.):

Iodine	1 Gm.
Alcohol, a sufficient quantity,	
To make a solution measuring	100 mils

For Blood Reaction

Solution of Guaiac:

Guaiac	2 Gm.
Dehydrated Alcohol, a sufficient quantity,	
To make a solution measuring	100 mils

Oxygenated Oil of Turpentine.

Ether containing Hydrogen Dioxide.

Aloin, isobarbaloin containing barbaloin.

For Diacetic Acid Reaction

Solution of Ferric Chloride (official) used for Gerhardt's test.

For Diazo Reaction, Ehrlich

1. Sodium Nitrite	1 Gm.
Distilled Water, a sufficient quantity,	
To make	200 mils
2. Sulphanilic Acid	5 Gm.
Hydrochloric Acid	50 mils
Distilled Water, a sufficient quantity,	
To make a solution measuring	100 mils

Dissolve the sulphanilic acid in about 700 mils of distilled water to which the hydrochloric acid has been added and follow with enough distilled water to make the product measure 1000 mils.

For use, 1 mil of the sodium nitrite solution should be mixed with 50 mils of the sulphanilic acid solution.

For Indican Reactions

Solution of Chlorinated Lime:

A saturated solution of chlorinated lime diluted with an equal volume of distilled water and filtered.

Obermeyer's Solution:

Ferric Chloride	0.4 Gm.
Hydrochloric Acid, a sufficient quantity,	
To make a solution measuring	100 mils

Solution of Lead Acetate:

Lead Acetate	25 Gm.
Distilled Water, a sufficient quantity,	
To make a solution measuring	100 mils

For Pentose Reactions

Bial's Reagent:

Orcin	1 Gm.
Hydrochloric Acid	500 mils
Solution of Ferric Chloride	25 drops

Dissolve the orcin in the hydrochloric acid and add the solution of ferric chloride.

Phloroglucinol (see page 1507).

For the Estimation of Urea

Solution of Sodium Hypobromite:

1. Bromine	125 Gm.
Sodium Bromide	125 Gm.
Distilled Water, a sufficient quantity,	
To make a solution measuring	1000 mils
2. Sodium Hydroxide	225 Gm.
Distilled Water, a sufficient quantity,	
To make a solution measuring	1000 mils

The reagent should be freshly prepared by mixing equal volumes of solutions 1 and 2 and diluting the resulting mixture with one and a half volumes of distilled water.

For Sugar Reactions

Solution of Sodium Hydroxide:

Sodium Hydroxide	10 Gm.
Distilled Water, a sufficient quantity,	
To make a solution measuring	100 mils

Solution of Copper Sulphate:

Copper Sulphate	10 Gm.
Distilled Water, a sufficient quantity,	
To make a solution measuring	100 mils

Nylander's Reagent:

Potassium and Sodium Tartrate	4 Gm.
Sodium Hydroxide	10 Gm.
Bismuth Subnitrate	2 Gm.
Distilled Water, a sufficient quantity,	
To make	100 mils

Dissolve the potassium and sodium tartrate in 90 mils of distilled water. Add the bismuth subnitrate to the solution, shake the mixture thoroughly and then filter through glass wool. Preserve and dispense this solution in amber-colored bottles.

Fehling's Solution (use Alkaline Cupric Tartrate V.S.).

Pavy's Solution:

1. Copper Sulphate	4.158 Gm.
Distilled Water, a sufficient quantity,	
To make a solution measuring	500 mils
2. Potassium and Sodium Tartrate	20.4 Gm.
Potassium Hydroxide	20.4 Gm.
Stronger Ammonia Water	300.0 mils
Distilled Water, a sufficient quantity,	
To make a solution measuring	500 mils

For use, mix equal quantities of the two solutions.

Phenylhydrazine Hydrochloride (see page 1507).

Sodium Acetate: Neutral to litmus paper.

Fermentation test with yeast.

Reagents for the Examination of Gastric Contents

Congo Red Test Paper:

Saturate filter paper with an aqueous solution of Congo Red (1 in 1000). Dry and cut the paper into strips and preserve them in well-stoppered glass vials.

Saturated Alcoholic Solution of Methylthionine Chloride (official) *Methylene Blue*).

Alcoholic Solution of Dimethylaminoazobenzene (see page 1497) (1 in 200).

Günzburg's Reagent:

Phloroglucinol	2 Gm.
Vanillin	1 Gm.
Alcohol	30 mils

Dissolve the ingredients in the alcohol.

Tenth-normal Hydrochloric Acid V.S.: Dilute 1 volume of normal hydrochloric acid V.S. with exactly 9 volumes of distilled water.

Tenth-normal Potassium Hydroxide V.S.

Phenolphthalein (official).

Solution of Rosolic Acid:

Rosolic Acid	1 Gm.
Alcohol, a sufficient quantity,	
To make a solution measuring	100 mils

Carminfibrin:

Heat freshly-drawn beef blood, wash the stringy coagulated fibrin in running water until decolorized, cut the fibrin into small pieces of uniform size and macerate it in alcohol for several days. Then transfer the fibrin for one or two days to a 0.5 per cent. ammoniacal solution of carmine, which contains as little excess of ammonia as possible, and keep it cool until the fibrin is thoroughly stained. Wash the product in distilled water until the wash-water is no longer colored, squeeze it out well, and then preserve it in glycerin. Before using, carefully wash the carminfibrin in distilled water to free it from glycerin.

Reagents for the Examination of Blood

Hayem's Solution:

For red blood-corpuscles:

Sodium Sulphate	5	Gm.
Sodium Chloride	1	Gm.
Corrosive Mercuric Chloride	0.5	Gm.
Distilled Water	200.0	mils

Dissolve the salts in the distilled water and filter.

Toison's Solution:

Methyl Violet 6B	0.025	Gm.
Sodium Chloride	1.000	Gm.
Sodium Sulphate	8.000	Gm.
Glycerin	30.000	mils
Distilled Water	300.000	mils

Dissolve the salts in the distilled water and add the methyl violet and the glycerin.

For white corpuscles:

Acetic Acid (U. S. P.)	1 mil
Distilled Water	99 mils

Mix them.

Solution for Hemoglobin Estimation (*Sahli's hemometer*)*:*

Tenth-normal hyrochloric acid V.S. saturated with chloroform. This solution should always be freshly prepared and be dispensed in dark amber-colored bottles.

Jenner's Stain:

1. Eosin	0.5	Gm.
*Methyl Alcohol, a sufficient quantity,		
To make a solution measuring	100	mils
2. Methylthionine Chloride (Methylene Blue)	0.5	Gm.
*Methyl Alcohol, a sufficient quantity,		
To make a solution measuring	100	mils

For use mix 25 mils of eosin solution with 20 mils of methylene blue solution.

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*Rectified wood alcohol, sp. gr. about 0.812 at 25° C.

Ehrlich's Triacid Stain:

Saturated Aqueous Solution of Orange-G	120 to 125 mils
Saturated Aqueous Solution of Acid Fuchsin	80 to 165 mils
Saturated Aqueous Solution of Methylene Green	125 mils
Distilled Water	300 mils
Dehydrated Alcohol	200 mils
Glycerin	100 mils

Mix.

Wright's Stain:

Wright's Stain (Grübler's dried powder)	0.1 Gm.
*Methyl Alcohol	60.0 mils

Giemsa's Stain:

Azur II–Eosin	0.3 Gm.
Azur II	0.8 Gm.
Glycerin	250.0 mils
*Methyl Alcohol	250.0 mils

Dissolve the dyes in the methyl alcohol and add the glycerin and filter.

Stains and Accessories for Use in Connection with the Study of Micro-organisms

Alum-hematoxylin Solution:

Hematoxylin, crystals	1.0 Gm.
Saturated Aqueous Solution of Ammonium Alum	100.0 mils
Distilled Water	300.0 mils
Thymol	0.5 Gm.

Dissolve the hematoxylin in a little distilled water by the aid of heat, add the other ingredients, and expose the combined solution to the light, in a bottle loosely stoppered, until it has assumed a dark red color, then filter. The thymol is added as a preservative.

Mayer's Hemalum:

Hematein or its ammonium salt	1.0 Gm.
Alcohol, 90 per cent	50.0 mils
Alum	50.0 Gm.
Distilled Water	1000.0 mils
Thymol	0.5 Gm.

Dissolve the hematein in the alcohol by the aid of heat, add the thymol, and then this solution to the alum dissolved in the distilled water, and then filter. The thymol is added as a preservative.

Alcoholic Solution of Methyl Violet 6B:

Methyl Violet 6B	10 Gm.
Alcohol, a sufficient quantity,	
To make a solution measuring	100 mils

Borax-Methylene Blue Solution:

Methylthionine Chloride (Methylene Blue)	2 Gm.
Boiling Solution of Sodium Borate (1 in 20) a sufficient quantity,	
To make a solution measuring	100 mils

Löffler's Methylene Blue Solution:

Methylthionine Chloride (Methylene Blue)	0.5 Gm.
Alcohol	30.0 mils
Tenth-normal Potassium Hydroxide V.S.	2.0 mils
Distilled Water	98.0 mils

Dissolve the methylene blue in the alcohol, add the potassium hydroxide and distilled water.

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* Rectified wood alcohol, sp. gr. about 0.812 at 25° C.

Solution of Carbol Methyl Violet:

Alcoholic Solution of Methyl Violet 6B	10 mils
Aqueous Solution of Phenol (1 in 20), a sufficient quantity	
To make a solution measuring	100 mils

Solution of Carbolfuchsin:

Alcoholic Solution of Fuchsin (1 in 10)	10 mils
Aqueous Solution of Phenol (1 in 20)	100 mils

Mix.

For Tubercle Bacilli

Solution of Carbolfuchsin (see above).

For Decolorizing

Ebner's Fluid:

Hydrochloric Acid	2.5 mils
Sodium Chloride	2.5 Gm.
Distilled Water	100.0 mils
Alcohol	500.0 mils

Prepare a solution.

Nitric Acid Solution:

Nitric Acid	30 mils
Distilled Water, a sufficient quantity,	
To make a solution measuring	100 mils

Diluted Alcohol.

Diluted Lugol's Solution (Gram's Iodine Solution):

Iodine	1 Gm.
Potassium Iodide	2 Gm.
Distilled Water, a sufficient quantity,	
To make a solution measuring	200 mils

For Counter Staining

Löffler's Methylene Blue Solution (see page 1561).

Gram's Stain (Aniline Water—Methyl Violet 6B Solution):

Aniline	15 mils
Saturated Alcoholic Solution of Methyl Violet 6B	7 mils
Dehydrated Alcohol	10 mils
Distilled Water, a sufficient quantity,	
To make	100 mils

Shake the aniline with 65 mils of distilled water for several minutes; filter the resulting opalescent aniline water through a moistened filter, pour the filtrate into a solution prepared by mixing the other liquids and add sufficient distilled water to make 100 mils.

Diluted Carbolfuchsin Solution:

Solution of Carbolfuchsin (see above)	1 mil
Distilled Water	4 mils

Prepare a solution.

Accessories

Xylene (see page 1515).
Oil of Clove (official).
Oil of Cedarwood (see page 1505).
Canada Turpentine (Canada Balsam) (see page 1496).

Culture Media

Bouillon Stock:

Lean Beef	500 Gm.
Or Extract of Beef	3 Gm.
Distilled Water, a sufficient quantity,	
To make	1000 mils

Mix thoroughly 500 Gm. of finely-minced lean beef with 1000 mils of cold distilled water, heat it to boiling in a closely covered dish or flask and keep it at that temperature for one hour. If extract of beef is used to make bouillon stock, boil the solution for one-half hour. Filter the resulting bouillon through a well-wetted filter, until clear and use it as the basis for the following combinations:

Plain Bouillon:

Peptone	10 Gm.
Sodium Chloride	5 Gm.
Normal Sodium Hydroxide V.S.	
Bouillon Stock, each a sufficient quantity,	
To make	1000 mils

Dissolve the peptone and sodium chloride in the bouillon stock by means of heat and add sufficient normal sodium hydroxide V.S. to make the mixture neutral to litmus. Then filter the product through a well-wetted filter, fill it into suitable containers and sterilize.

Glucose Bouillon:

Glucose (dry)	10 Gm.
Peptone	10 Gm.
Sodium Chloride	5 Gm.
Normal Sodium Hydroxide V.S.	
Bouillon Stock, each, a sufficient quantity,	
To make	1000 mils

Dissolve the glucose, peptone, and sodium chloride in the bouillon stock by means of heat and add sufficient normal sodium hydroxide V.S. to neutralize the resulting solution. Then filter the product through a well-wetted filter, fill it into suitable containers and sterilize by the discontinuous method.

Plain Gelatin:

Gelatin	100 Gm.
Peptone	10 Gm.
Sodium Chloride	5 Gm.
Normal Sodium Hydroxide V.S.	
Bouillon Stock, each, a sufficient quantity,	
To make	1000 mils

Dissolve the gelatin, peptone, and sodium chloride in the bouillon stock by means of heat and add sufficient normal sodium hydroxide V.S. to neutralize the resulting mixture. Filter the warmed product through filter paper, fill it into suitable containers and sterilize by the discontinuous method.

Glucose Gelatin:

Glucose (dry)	10 Gm.
Gelatin	100 Gm.
Peptone	10 Gm.
Sodium Chloride	5 Gm.
Normal Sodium Hydroxide V.S.	
Bouillon Stock, each, a sufficient quantity,	
To make	1000 mils

Dissolve the glucose, gelatin, peptone, and sodium chloride in the bouillon stock by means of heat and add sufficient normal sodium hydroxide V.S. to neutralize the resulting mixture. Then filter the product through paper, fill it into suitable containers and sterilize by the discontinuous method.

Plain Agar-agar:

Agar	15 Gm.
Peptone	10 Gm.
Sodium Chloride	5 Gm.
Normal Sodium Hydroxide V.S.	
Bouillon Stock, each, a sufficient quantity,	
To make	1000 mils

Dissolve the agar, peptone, and sodium chloride in the bouillon stock by means of heat and add a sufficient quantity of normal sodium hydroxide V.S. to neutralize the resulting mixture. Then filter the warmed product through paper, fill it into suitable containers and sterilize.

Glucose Agar-agar:

Glucose (dry)	10 Gm.
Agar	15 Gm.
Peptone	10 Gm.
Sodium Chloride	5 Gm.
Normal Sodium Hydroxide V.S.	
Bouillon Stock, each, a sufficient quantity,	
To make	1000 mils

Dissolve the glucose, peptone, and sodium chloride in the bouillon stock by means of heat, and add a sufficient quantity of normal sodium hydroxide V.S. to neutralize the resulting mixture. Then filter the warmed product through paper, fill it into suitable containers and sterilize by the discontinuous method.

Glycerin Agar-agar:

Glycerin	60 mils
Agar	15 Gm.
Peptone	10 Gm.
Sodium Chloride	5 Gm.
Normal Sodium Hydroxide V.S.	
Bouillon Stock, each, a sufficient quantity,	
To make	1000 mils

Dissolve the glycerin, agar, peptone, and sodium chloride in the bouillon stock by means of heat and add a sufficient quantity of normal sodium hydroxide V.S. to neutralize the resulting mixture. Then filter the warmed product through paper to fill it into suitable containers and sterilize.

Lactose-litmus Agar-agar:

Sugar of Milk	10 Gm.
Agar	15 Gm.
Peptone	10 Gm.
Sodium Chloride	15 Gm.
Normal Sodium Hydroxide V.S.	
Azolitmin Test Solution (see page 1536)	
Bouillon Stock, each, a sufficient quantity,	
To make	1000 mils

Dissolve the sugar of milk, agar, peptone, and sodium chloride in the bouillon stock by means of heat and add a sufficient quantity of normal sodium hydroxide V.S. to neutralize the resulting mixture. Then filter the warmed product through paper, add a sufficient quantity of azolitmin solution to impart to the resulting mixture a pale blue color, fill into suitable containers and sterilize by the discontinuous method.

Blood Serum (Löffler's Mixture):

Glucose Bouillon	250 mils
Horse or Beef Blood Serum	750 mils

Run the mixture of glucose bouillon and beef or horse blood serum into properly sterilized test tubes, and coagulate it by means of heat so as to form a slanting surface for culture purposes.

PART V

MAGISTRAL PHARMACY[1]

UNDER the head of Magistral or Extemporaneous Pharmacy will be considered the preparation and dispensing of medicines intended *to meet the occasion* and which are to be compounded at once. The subject of official or galenical pharmacy has been considered in the previous pages, the distinction being that in the latter the preparations are intended to be permanent, and are generally made in advance and kept on hand ready for use, while those which are magistral are mostly intended to last during the occasion which calls them into existence.

There are several classes of official medicines in which both permanent and extemporaneous preparations are embraced. It has been deemed most practical to consider such under the above head. Examples are found in plasters, powders, ointments, etc. Some of these are generally kept on hand ready for use. If they are not called for soon, they become stale or deteriorated, and experience soon demonstrates that the best plan is rapidly to improve the apparatus and facilities of the store to the highest point, so that all extemporaneous preparations may be quickly and skilfully compounded on call, and thus a reputation is soon acquired for always dispensing those which are fresh. For this reason, most ointments should not be made in larger quantities than are necessary to supply the demand of the moment.

Magistral Pharmacy is unquestionably the most important division of the whole subject. It embraces the principal amount of the labor in the store, and calls for the exercise of more tact, knowledge, and ability than any other branch. Owing to the fact that the ability to successfully practise extemporaneous pharmacy depends largely upon the personal qualities of the pharmacist, very little can be written upon the subject which would be generally useful. Good training under the watchful eye of a skilled preceptor and practical experience will alone give the confidence and knowledge of details that assure success. All that will be attempted under this head will be to collect and arrange such points as the author has found useful in his own experience, in the hope that at least some of them may be of service to others. A chapter on the arrangement of the store, with a description of the facilities for practising extemporaneous pharmacy, will properly introduce the subject.

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[1] The word magistral is derived from *magister*, a master, and is defined as "a term applied to medicines prescribed for the occasion, by a competent person, in distinction from such as are official, or kept prepared in the shops. As the latter are prepared according to a certain formula, an intelligent apprentice is generally equal to the task; but the knowledge of a master is needed to give directions for an original preparation."—*Thomas.*

CHAPTER LXIII

DISPENSING

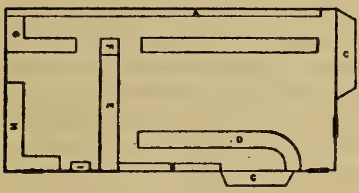
Arrangement of the Store, Laboratory, and Cellar

Selecting a Location for a Dispensing Store.—The selection of a proper location for establishing a pharmacy is in some respects the most important and responsible of all the duties of the pharmacist. As it is largely a question depending upon the personal qualifications, attainments, and financial ability of the individual or firm, it would be useless to offer anything more than a general observation upon this subject. Every pharmacist should select the location in which he will be most likely to achieve the greatest amount of *success*. The foregoing sentence will probably be construed by most readers to mean the field which will yield the largest pecuniary return; yet he is wisest whose expectations are tempered with moderation, and who looks for his reward to the happiness and satisfaction derived from a life filled with those daily deeds of service to his fellowmen, which from long custom or lack of appreciation fail to be classed as merchantable commodities. The general practice in America is to select a prominent place for a pharmacy at the intersection of principal streets, and the "corner drug store" is a well known phrase. Aside from the business view concerned in this selection, there is a great advantage derived from better light and ventilation, but the disadvantage of more dust. There are occasional opportunities today, in the larger cities, to locate a prescription pharmacy in what is termed a "professional building," where many physicians' and dentists' offices are located. The value of such a location is self-evident.

Apportioning Space.—The room should be at least twice as long as it is broad, in order that a suitable division of the space may be secured, so that about two-thirds may be devoted to dispensing and one-third to compounding. A high ceiling is a great desideratum. The doors should be ample, with movable transoms to secure ventilation and permit the escape of the heated air and vapors which accumulate from the lights at night and from other sources. The transoms may be suspended in the middle, and during the day, even in winter, if they are kept partly opened, the condensation of moisture upon the glass bulk windows, due to evaporating operations going on in the store or laboratory, will be largely avoided. If a chimney breast is available in the room, it will be found to be a desirable acquisition in aiding in ventilation and the escape of noxious vapors arising from chemical operations. The dispensing department is used principally for displaying the stock and for conducting the business with the customers, the prescription department for compounding prescriptions and making preparations. Much diversity of opinion exists among good pharmacists with regard to the proper method of division between these two departments. Some hold that they should be entirely separated from each other, the prescriptions being compounded in a separate room; others, that nothing but a low counter should mark the dividing line. Probably the most satisfactory arrangement to adopt is to place across the store a prescription counter having a large glass plate in the centre, which will permit the customer to see into the prescription department if he desires to, but which will not be a standing invitation to inquisitive persons to walk in and annoy by conversation those who are engaged in compounding prescriptions.

Fig. 466 shows the plan of a corner pharmacy adapted for a moderate business. It provides for two bulk windows, C C, and two doors. A and B represent the space devoted to upright fixtures and shelving,—A, the former, for the bottles, drawers, cans, drawer cans, etc.; B, closets for holding finished packages ready for sale. In front of A the long main counter is shown, while D represents the second counter. The spaces E and F are apportioned for the prescription counter, and the adjoining desks, G and H, show spaces devoted to working counters for pharmaceutical operations, while I represents the sink.[1] The prescription counter should be well lighted. If it is impossible to have a window in the position of the one over the counter, H, one of the "prism lights," now largely used for reflecting light from the outside into dark corners, may be used.

Fig. 466



Plan of store

Window Fixtures.—Plate glass, although expensive, is now so generally in use, and so satisfactory, that it is usually true economy to select it for bulk windows.

The principle adornments of the pharmacist's window are those ancient emblems of his art,—the show bottles. These should never be exhibited if they cannot be made to present a creditable appearance. They need not be of elaborately cut glass, but the colored liquids should be bright and transparent and the bottles clean and free from dirt and dust. (Formulas for show bottle colors are given in Part VI.)

Arrangement of Objects.—One of the most difficult subjects to treat is the proper arrangement of a pharmacist's window. In the general stores of our large cities, window dressing, as it is termed, is in the hands of trained men, who earn a comfortable livelihood by the "profession." It is far easier to note the objects which should not be exposed than to indicate those which are suitable. *Legitimate and proper objects are always found in the products of the pharmacist's own skill and labor.* Many chemical salts can be crystallized in thin glass dishes, and these, if the salt is colorless or white, can be shown to advantage on a background of black velvet; if the salt is dark colored, like chrome alum, a white background should be chosen. Masses of crystals of various colors, alum, copper sulphate, potassium ferrocyanide, etc., form attractive objects, if they are novelties. These may be obtained from the manufacturing chemists. Chemical or pharmaceutical apparatus, tastefully displayed, rarely fails to excite the admiration of the passers by, while if some simple pharmaceutical process is shown in automatic operation, such as the distillation of water or colored liquids in glass retorts, with a glass Liebig condenser, two objects are gained,—a supply of the distillate is secured, and the reason for possessing the window is legitimately realized. Growing plants of the materia medica can often be obtained by applying to conservatories, or, with the exercise of a little patience and care, some of these may be grown at home. If these plants be rare, or of foreign origin, the interest will be greatly enhanced. This point, however, should always be kept in view—the objects should have some connection with pharmacy. Appropriate labels should accompany the objects exhibited, or the annoyance of having to answer trivial questions many times in the day will be experienced. An instructive *series* of pharmaceutical exhibitions may be devised, the series to extend through many months. To illustrate : an empty ceroon which has held cinchona bark should be obtained, and a reproduction made, through the aid of some friend clever with the pencil, of some of the prints to be found in the books, of natives gathering cinchona bark, and also of the cinchona tree. Some large, handsome pieces of the bark should be selected, showing the different grades and qualities. Then there should be exhibited, in appropriate bottles, a series of all the *home made* pharmaceutical preparations of cinchona bark, and, for the centre piece, choice specimens of all the cinchona alkaloids ; then the pharmaceutical preparations of the alkaloids in the background, etc. A clearly written statement should be shown in the window, giving interesting details of each object. When the interest in this subject has waned, the same method may be applied to nux vomica, coca, rhubarb, opium, eucalyptus, senna, etc., and other similar subjects. It will be readily seen that the purpose of exhibitions of this character is to impress the community with the fact that the proprietor of the store is not only a merchant and dealer in the products of the skill of others, but is also a manufacturer himself.

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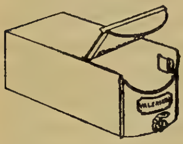
[1] Estimates, plans with illustrations, etc., are now freely furnished by druggists' outfitters. (See advertisements in the pharmaceutical journals.)

There is little need to devote more space to this question, since pharmaceutical journals deal very elaborately with window dressing and several books have been published on the subject. It must be clear, however, that displays of the above character are more in keeping with the professional status of the pharmacist in the community than the heterogeneous and often vulgar exhibitions of objects sometimes seen in druggists' show windows.

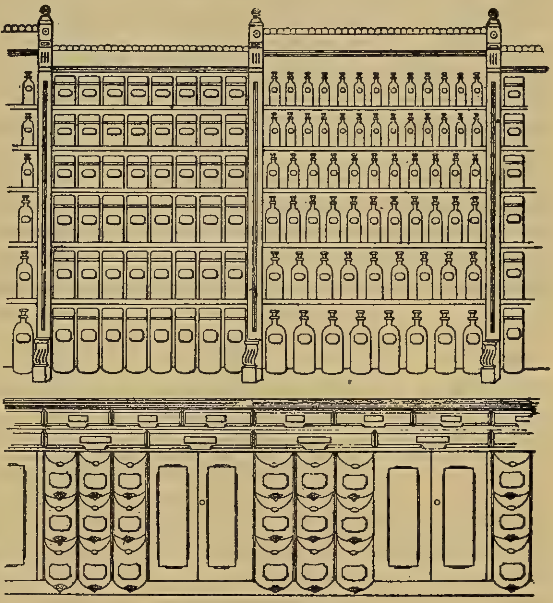
Shelving and Wall Fixtures.—The character of the permanent fixtures of the store has much to do with the comfort and convenience of conducting a pharmacy. The selection of the kind of wood to be used will depend upon the amount of light in the store, the location, and the climate. *Hard wood* is always the cheapest in the end, although the most expensive at first. If the room is exposed to a great deal of light, black walnut is to be preferred, because it shows discolorations less than any other hard wood ; but if the tone of the room is dark, a more cheerful appearance must be given to the store, and oak, ash, cherry, or mahogany will be preferable. Oak and ash, however, are not so serviceable as the others, because of their tendency to show stains. The wall fixtures generally consist of a long row of drawers four feet high, with shelves above for holding the shop bottles, cans, etc., on one side, and of a series of closets below, with shelves having glass fronts above, for the other side. Most crude drugs and chemicals, herbs, etc., are kept in wooden drawers arranged in sections. The objections to wooden drawers for this purpose are several. If the drug is odorous, like valerian, sassafras, asafetida, etc., it will surely communicate its peculiarities to its less pronounced neighbors, like arrowroot, sodium bicarbonate, etc. Again, rats and mice have strong likings for some of the articles of the materia medica, and a wooden drawer offers no impediment to their sharp teeth. Japanned and lacquered tin or tinned copper cans appropriately labelled have come into use as substitutes, and when properly made are perfectly satisfactory. Fig. 467 shows a can which is intended to take the place of a drawer. The lid is so arranged that the drawer must be pulled out nearly half way before it can be raised,—the advantage being that the bad habit of leaving the drawers partly open, thus permitting the admission of foreign substances, vermin, etc., is obviated, there being but two possible positions for this drawer can,—one with the lid raised and the mouth of the can wide open, the other with the lid down close. A label case in the corner of the can is the suggestion of Charles A. Heinitsh, of Lancaster. It has the merit of keeping the label for each drug in its appropriate container. Instead of the unbroken and monotonous array of drawers so frequently seen, a more convenient arrangement, presenting a better appearance, will be found to consist in alternating the sections of drawers or drawer cans with closets, as shown in Fig. 468. These closets should be used for packages and articles which are generally in active demand and which must be dispensed quickly. In this connection it may be stated that a stock of small packages of regular articles of the materia medica, like flowers of sulphur, cream of tartar, sodium bicarbonate, in the quantities frequently demanded

Fig. 467



Drawer can

Fig. 468

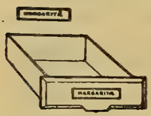


Section of wall fixtures

by customers, should be kept in a box or compartment of the drawers or drawer cans. This plan greatly facilitates quick dispensing, economizes time and labor, and leads the assistant to make neat packages, by training him in that duty thoroughly at times when he is not otherwise engaged. If there is not room in the proper receptacle for these labelled packages, they may be kept in glass furniture jars in some accessible place.

Fig. 468 also illustrates the arrangement of two sections of fixtures, one for bottles and the other for cans. Each section should be independent, or joined to its neighbor with dowelpins, so that at any time they may be separated, rearranged, if necessary, or taken down entirely. The design shown is unpretentious, and intended for a store doing a moderate business. If the fixtures are made of mahogany, oak, or walnut, the effect is much better than if soft wood, painted or stained, is used. It will be observed that the proportionate height of the fixtures is such that a short ladder is necessary to reach the top row of bottles and cans. This arrangement is a matter of necessity in stores located in large cities and towns, where space is very valuable; but whenever it can be avoided it is desirable that it should be, and if the shelves are carried to just such a height as will permit the bottles to be reached without using a ladder, much inconvenience will be obviated. The careless habit of pulling out a drawer as a step to reach a bottle on an upper shelf is broken up by the use of the drawer cans and closets, as shown in the illustration. The shallow drawers above these are not intended for holding drugs, but serve to contain small articles in constant demand, like camel's hair pencils, gelatin pearls, seidlitz powders, etc. There should be sufficient difference between the depth of the shelves for the bottles and cans and that of the closets below to permit a counter top eight inches wide to be made above the closets. This will be almost indispensable, as affording a place for retaining packages to be sent out and of temporary lodgement for articles received. This counter should be cleared and all articles distributed every morning before the busy hours arrive.

Fig. 469



Shallow drawer

Fig. 469 shows one of these shallow drawers. The label is the principal feature. It was devised by the author some years ago, to replace the labelled drawer pulls furnished by the dealers in druggists' furniture, which were in use at that time and were objectionable in several respects. The simplicity and durability of this label are its prominent advantages. It is made of plate glass, with bevelled edges; the background is of pure gold leaf, and the letters are black and in plain Egyptian style, or black letter, without shading. They are painted upon the back of the glass, and covered with a coat of varnish. The glass label is let into the front of the door by chiselling out a depression, as deep as the glass is thick, slightly larger than the label. The back of the glass label is then covered with a thick paste of red lead in boiled linseed oil and pressed into place, the edges being finished with colored putty. The lower edge of the drawer has a projection which serves as a pull.

Dispensing Counter.—The arrangement of the dispensing counter will depend upon whether it is to serve also as a prescription counter.

A combination counter should always be avoided, if possible, as the operations involved in compounding prescriptions require the closest attention, and should always be performed where the greatest freedom from interruption can be secured. This can never be had behind the dispensing counter. The plans shown on page 1575 do not, therefore, embrace a combined dispensing and prescription counter; but, if one is absolutely necessary, the main features of each can be easily merged into one. The top of the dispensing counter should be of marble or hard wood. Where space is valuable, the top of the front of the counter may overhang four inches, and room thus be obtained for a row of shelving covered with glass doors. These are shown also in front of the prescription counter (see Fig. 479). If the shelves are filled with attractive objects, particularly with special preparations made by the proprietor, they serve the excellent purpose of keeping them continually before the eye of those who frequent the store, and they may justly be called "silent salesmen." If a triangular base four inches high is placed at the bottom, no danger need be apprehended of customers breaking the glass. The case which was in the author's possession was in daily use for ten years without a single fracture occurring through the carelessness of a customer. The glass should be one-eighth-inch plate. If space is not particularly valuable, the counter front may be embellished with pilasters or panels, according to the taste of the owner, and the preparations shown in glass cases. A hardwood counter will, however, prove to be much the cheaper in the end, as the front is subjected to a great deal of wear and tear, and will require frequent painting if made of soft wood; the top of the counter may be sometimes filled with melted paraffin and rubbed, this will give a more durable surface than paint. The back of the counter should be utilized for containing drawers for heavy, unsightly goods, supplies of paper, corks, twine, sponges, glue, sand paper, plaster, labels for articles to be dispensed, etc. A sink at one end will often prove a convenience. It will, indeed, be necessary if soda water is dispensed at this counter.

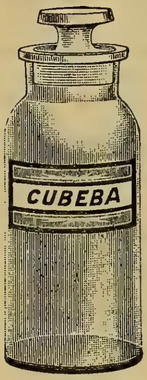
Store Furniture.—This term generally denotes the containers used to hold the medicinal substances which are to be dispensed. The furniture may consist of wide mouth or salt mouth bottles, wooden drawers, drawer cans, and cans or counter urns, for the solid articles of the materia medica, while the liquids are universally dispensed from bottles and cans. The furniture other than that made from glass has been already considered under the head of fixtures. The subject of the selection of the glassware in such sizes and shapes as shall be adapted to the wants of the store is an important one. Very little assistance, however, can be rendered in a work of this kind, because a list suitable for a store in one location would be useless for one differently situated. In selecting the sizes for the containers, whether of glass, tinned iron, or wood, the space to be devoted to them should first be decided upon, and then the number of bottles, cans, or drawers to occupy the space is easily determined. The following points may serve as a guide in selecting the kind of container:

1. Solid substances which are subject *to injury by exposure to light* should not be placed in glass, like salts of the alkaloids, scaled iron

salts, powdered savin, digitalis leaves, etc. 2. Odorous drugs, like hedeoma, asafetida, valerian, serpentaria, etc., should not be placed in wooden drawers, but should be put into the shop cans. 3. Volatile oils should not be placed in the pharmacist's shop furniture at all. Small quantities only are dispensed, and the oils should be kept in small amber glass bottles, away from exposure to light, preferably in a close closet. 4. Corrosive or deliquescent salts should not be placed in tinned iron cans. Glass vessels are properly used for these.

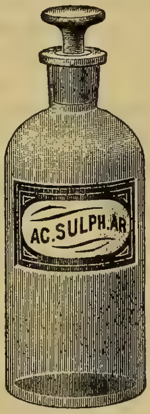
Glass Furniture.—Shop bottles are generally of four kinds—*wide mouth* or *salt mouth*, *tincture* or *narrow mouth*, *syrup*, and *oil* bottles. Amber and blue glass are sometimes used—the former for substances which are injured by light, the latter for very active poisons. Figs. 470 and 471 show cuts of the wide mouth and narrow mouth shop bottles supplied by the Whitall Tatum Company, of Philadelphia.

Fig. 470



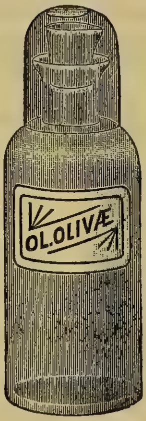
Wide mouth furniture bottle

Fig. 471



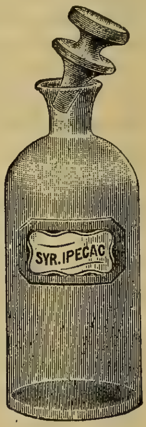
Narrow mouth furniture bottle

Fig. 472



Oil bottle

Fig. 473



Syrup bottle

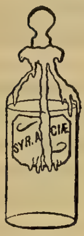
The *oil bottle* (see Fig. 472) has a cap, which protects the liquid from dust; the neck of the bottle is stoppered by a tube which has a lip, while the base of the tube is grooved on one side, to permit the oil adhering to it to flow back into the bottle.

The *syrup bottle* (see Fig. 473) does not have a ground, close-fitting stopper as do the other bottles holding liquids, but the stopper is purposely made to enter the neck loosely to prevent its sticking, yet it forms a sufficiently tight connection to prevent loss by evaporation and to exclude dust. Always remove the last drop from the lip of the syrup container when pouring from it or the syrup bottle will soon present the appearance shown in Fig. 474.

Fig. 475 is a tubulated or aspirator bottle. It has a glass tap joined to the bottle by grinding. This is held in its place securely by a metal screw collar. The contents come only into contact with glass, and thus contamination is prevented. It may be used for holding infusions after sterilization, the glass stopper in this case being replaced by a tuft of purified cotton (see page 329). It may also be used in connection with the rapid filtering apparatus (see Fig. 323).

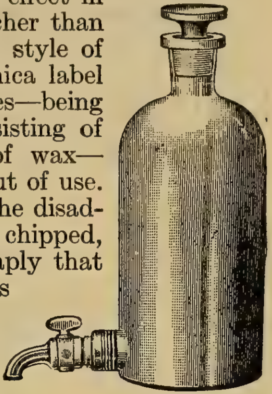
In placing the bottles upon the shelves, an alphabetical arrangement is undoubtedly the best. It is well, however, to group the strong acids in one place, and the very poisonous liquids in another. The labelling should be distinct and easily read, and the abbreviations not so short as to allow of any misunderstanding. There should be no shading of the letters. The plain black Egyptian letter on a plain gold ground is the best on this account, while the combined effect in a row of bottles so labelled is richer than where some obscure or composite style of label is adopted. The glass or mica label is universally used now for bottles—being cemented on with a mixture consisting of three parts of rosin and one part of wax—paper labels having almost gone out of use. These glass labels are subject to the disadvantage of being easily cracked and chipped, but they can be replaced so cheaply that this cannot be considered a serious objection. The recessed label has an advantage in this respect, the octagonal depression in the bottle enabling the glass label to be cemented in its place without exposing the edges, thus giving it protection. Fig. 476 shows a profile view of this label, and Fig. 471 a front view of an oblong label similarly recessed.

Fig. 474



Last drop effect

Fig. 475



Tubulated bottle

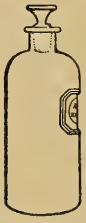
The following directions for attaching the glass labels are furnished by the Whitall Tatum Company:

Cement.—To one part of best yellow wax add three parts of rosin; melt together in an open pan or kettle, to the consistence of syrup.

Directions.—Place the dry bottle on a table in a nearly horizontal position in front of you. Pour the cement on the hollow side of the label with a spoon; then apply the label to the bottle with a gentle pressure. When the cement is hard remove the surplus, clean the bottle and label with a little kerosene oil, and wipe off with a damp towel.

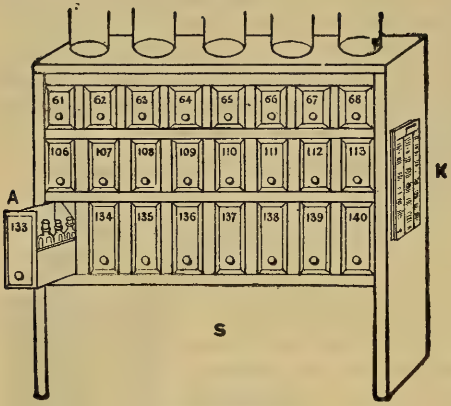
Fig. 477 shows a method of systematically storing little odd packages which are troublesome to place. This is a modification of the plan first seen by the author in Samuel A. D. Sheppard's store in Boston. A section back of the prescription counter is chosen, and a number of small drawers are arranged to hold five or six bottles in an upright position. This plan or modifications of it are much used to-day in the fitting out of drug stores. Fig. 478 shows the Schwartz Sectional cabinet, made by the Indianapolis Drug Cabinet Company, arranged for a prescription counter. As it is constructed in sections they may be fitted into irregular space in the store or may be added to as the demands of a business increase. The drawers swing to the left, after they are drawn out, that the contents may be readily accessible, and they are fitted with adjustable partitions to suit all sizes of bottles

Fig. 476



Recessed label furniture bottle

Fig. 477

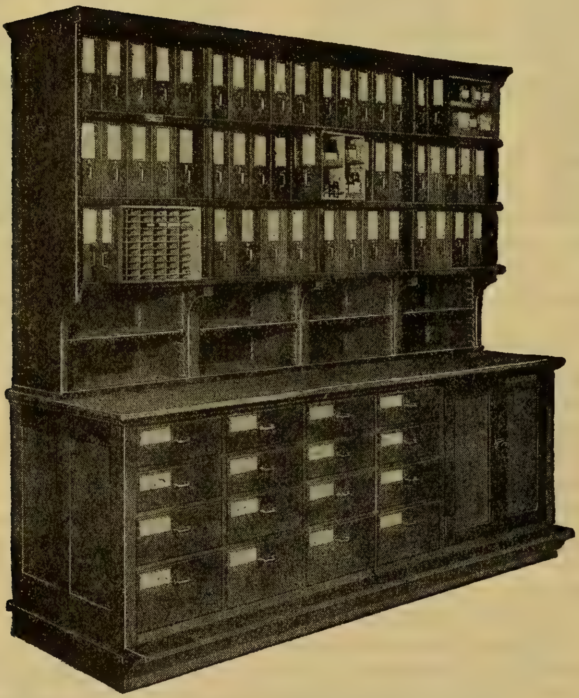


Odd package case

or packages. By this system the numerous articles of a drug store may be systematically arranged, be protected from light and dust, and readily located, especially if properly catalogued. All drawers should be numbered and also labeled with their contents.

The Prescription Counter.—This will probably require more care and thought to secure the most advantageous arrangement than any

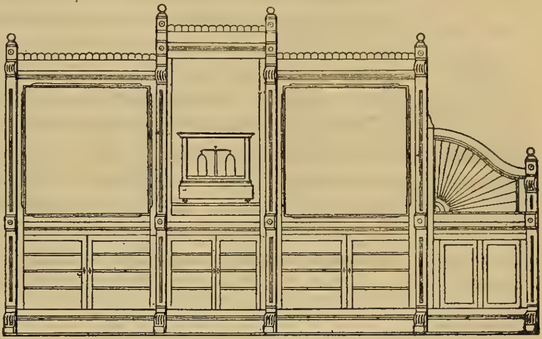
Fig. 478



Schwartz drug cabinet and prescription counter other feature of the store. Good light and a convenient water supply are absolute essentials. A corner location will generally afford a side window, from which plenty of light from the side and back may be had, while the sink should be close at hand. The counter should be of the same material—hard wood—as the fixtures; or, if hard wood has not been used for the fixtures, the counter top at least should be of walnut, mahogany, oak, ash, or cherry.

Fig. 479 shows the front of a prescription counter formerly used by the author. The upper portion is divided into three spaces, the middle one of which is covered with a single sheet of plate glass, while the other two are occupied by plate mirrors; the lower portion is divided into closets, which are protected by glass doors, and suitable articles are displayed on the shelves in the closets; these, like the closets under the dispensing counter, are very useful as receptacles for many small articles which are attractive to persons who are waiting for prescriptions.

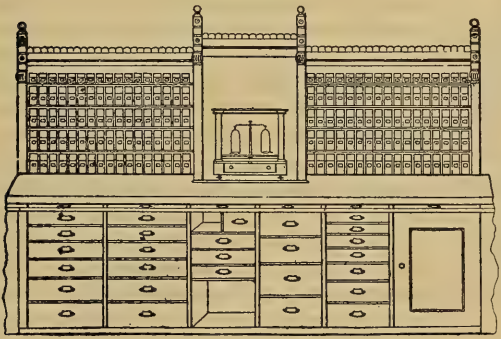
FIG. 479



Prescription counter, front view

The arrangement of the back of the prescription counter is probably of more importance than that of any other part of the fixtures. The fact that the customer rarely sees this part of the store is one of the reasons why it should *not* be neglected. The best reason for devoting thought and care to planning the arrangement of the prescription counter is that here, more than in any other place, the fate of a human life is often decided. Hence system, order, and cleanliness should be the guiding rule. Fig. 480 shows the back view of the prescription counter. The upper portion presents a series of open shelves, containing rows of japanned tin cans, uniform in color and in style of label with the shop cans. The lower shelf, in each section, is devoted to the volatile oils. These are contained in glass stoppered bottles, which are placed in the cans; or, if preferred, the original bottles in which the oils are bought are placed

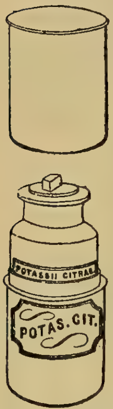
FIG. 480



Prescription counter, back view

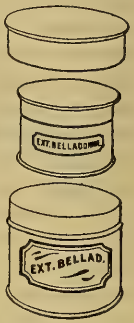
in the cans. The oils are thus protected from light, air, and dust, and in the latter case the label of the dealer is constantly before the dispenser, and the quality of the oil under surveillance. The second, third, and fourth rows are used to hold the chemicals and dry pharmaceutical non-poisonous products which are constantly in use. In compounding prescriptions, some of these cans are filled directly from the larger shop bottles, and the substance, if without action on the tin, is not first put into smaller bottles, but is placed at once in the can. Substances like sodium bromide, hydrated chloral, potassium citrate, etc., are placed in bottles, and these then put into the proper tin cans. Fig. 481 shows one of these cans. The upper row is devoted to extracts, these being contained in jars, as shown in Fig. 482. The cans should be thoroughly japanned, and the label may be painted in large, black, distinct letters upon a gold ground. The substances should be arranged alphabetically, so that they can be readily found when wanted. This arrangement enables the dispenser to exclude the light, air, and dust from the substances, and to use the original bottles in which the manufacturer has sold the chemical, thus enabling their product to be at once identified, besides lessening the danger of errors; while another advantage is that the unsightly display of bottles of all sizes and shapes containing chemicals, with the labels more or less worn, soiled, and fly specked, is avoided. The poisons, alkaloids, and very powerful substances should be kept in a separate closet, and the bottles marked with a poison mark; for, although the pharmacist should early learn to place no absolute dependence upon any *special system* of preventing errors, but always to realize that constant, unremitting vigilance is the only safeguard, the adoption of some expedient which will aid in calling attention to poisonous compounds serves to impress upon all, particularly the junior assistants, the fact that safety can be secured only at the expense of the most scrupulous care. Fig. 483 shows Holbe's poison closet. The arrangement shows three closets in one. To each is assigned separate apparatus with lock and key.

Fig. 481



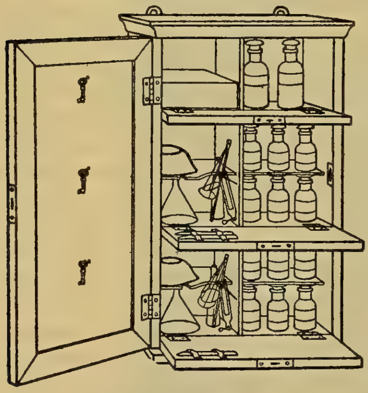
Can for prescription counter

Fig. 482



Extract can for prescription counter

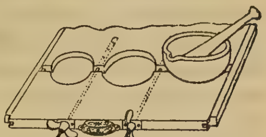
Fig. 483



Holbe's poison closet

The top of the prescription counter should be made of hard wood, and be at least one and one-half inches thick if durability is desired. The slides shown just under the edge of the counter are very convenient. They can be relied upon, when they are pulled out, in an emergency, to double the capacity of the counter. One of the slides may have a sheet of ground glass set into it by chiselling out sufficient of the wood on the face to allow the glass to be set in flush with the surface of the slide upon a bed of label cement (three parts rosin and one part yellow wax). This forms a convenient ointment slab, particularly for making up a rather large quantity of ointment. It is easily cleaned and kept in order. Two of the slides should be appropriated to folding powders and kept exclusively for this purpose, and one reserved for holding the pill machine when in use, while one may have three circular bevelled holes of different diameters cut through upon the front of the slide. If a strip equal in width to one-half the diameter of these holes is sawed out, as shown in Fig. 484, and then connected by two screw bolts which project entirely through the strip, it will be possible, by attaching thumb screws to the ends of the bolts, to clamp the mortar securely. The holes should be wider in diameter at the bottom than at the top, so that the "bite" of the clamp will be stronger when the mortar is securely clamped. It is useful in working tough pill masses, or in making emulsions quickly. The drawers in the counter are appropriated to various purposes. Those on the left are partitioned off, and contain pill, powder, and suppository boxes, each in its proper division. Ointment jars of various sizes occupy another set in the next row; the top drawer and the one immediately below it contain the pill machines; lozenge cutters, cachet machines, suppository moulds, etc., are in another drawer, spatulas, stirring rods, etc., in still another. Prescription bottles of all sizes (cleaned and dried, and, if preferred, corked) are in the next section, while cut labels, capping paper, scissors, and corks, in partitioned drawers, find places in the succeeding row. One of the upper drawers in the middle of the counter should be set apart for towels, while the open space below is convenient for holding the box to collect the scraps of paper and light waste which accumulate during the day. The closets hold the mortars and pestles, ointment slabs, etc.

FIG. 484



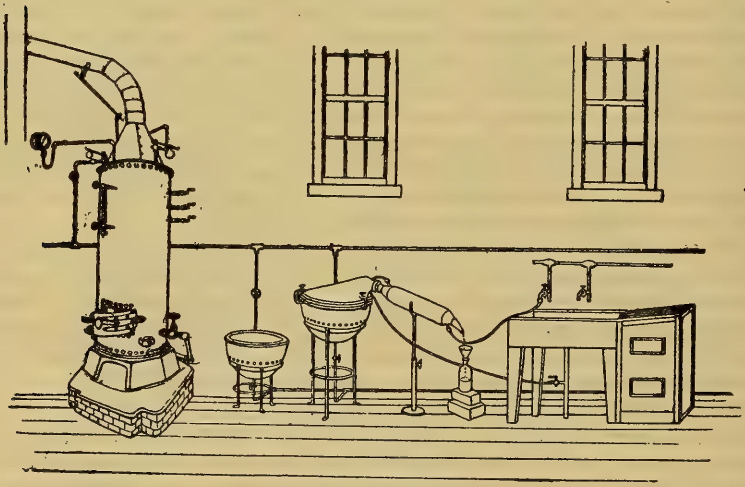
Device for holding mortars

Arrangement of Laboratory and Cellar.—The suggestions that are to be made upon the above subject must necessarily be of a very general character, as the circumstances of pharmacists vary greatly. The apparatus employed in the making of the various preparations has been already considered under the heads devoted to the subjects, hence the general arrangement must now receive attention.

The Laboratory.—This very important room in the pharmacy should be fitted with every facility for carrying on the various operations required, with ease, rapidity, and comfort. In most establishments but one room is available for this purpose, and this directly in the rear of the dipensing room. The manufacturing pharmacist, who makes preparations on the large scale, is compelled to devote much time and thought to the most advantageous arrangement of space, and he generally selects a location in an unfrequented portion of the town or city, or in the suburbs, where property is cheaper and railway facilities are abundant, while the retail pharmacist is fortunate indeed if he can set apart a special room on the first floor adjoining the dispensing room for a laboratory. The essential features of this room are a good light, an unfailing supply of cold and hot water, a good flue for carrying off vapors, and sufficient room for counters, closets, shelving, etc.

If steam can be introduced, so that steam kettles, evaporators, etc., can be used, it will be a great convenience. The boiler may be most suitably located upon the first floor or in the cellar. In those cases where the space for a permanent boiler cannot be spared, Prof. Patch's small steam boiler may be used. This will permit the use of steam without requiring much room, and, when an operation is concluded, the expense of keeping up the fire, as is the case in the use of coal, will be saved. A drying closet (Fig. 219) for desiccating drugs, herbs, lozenges, etc., on trays, is preferably located here, while furnaces, gas stoves, etc., must be suitably placed. Closets, arranged to hold stills, condensers, dishes, kettles, funnels, measures, etc., must be provided, while working counters, having either wooden tops covered with sheet lead, or slate tops, must be arranged so as to obtain the greatest number of advantages. Care should be exercised to have the floor, whether of stone or of brick, laid in cement, and slant gradually, so that when it is washed the water will naturally run toward the waste pipe, which should be located in one corner. If a stone or brick floor is inadmissible, an ordinary board floor, covered with sheet zinc in those portions likely to become wet, can be made to answer. The following illustrations will serve to give some idea of the general plan of a pharmacist's small working laboratory. The special apparatus is, of course, not figured, as it would interfere with the view of the general arrangement of the counters, etc. For a

Fig. 485

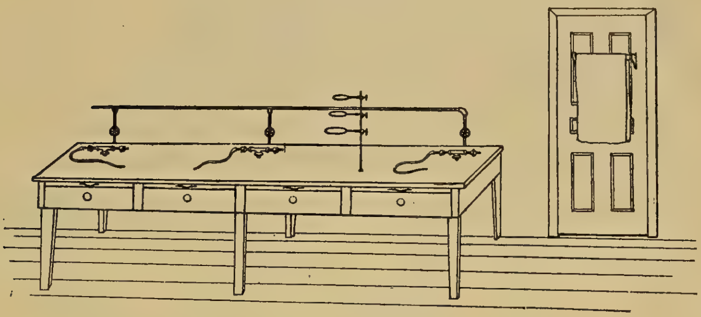


Laboratory, northern side

detailed description of the apparatus the reader is referred to the illustrations in the previous chapters and to the descriptions of the various processes of operative pharmacy.

The illustrations represent the counter and apparatus for the four sides of the room. Fig. 485 represents the northern side. This is devoted to the larger operations of evaporation, distillation, etc. The steam boiler, copper kettles, still, sink, etc., being here, a steam pipe from the boiler may be run into the store for heating purposes or to supply steam for small kettles, water baths, etc., there. Fig. 486 represents the eastern side, the most prominent object being a work table, with gas and steam attachments. The retort stand, shown in Fig. 187 may be used in either of the three holes in the counter, or it may be unscrewed and put away in pieces. Four large drawers and slides are seen in this counter. An adjustable vise might occupy space at one end, and at least one of the drawers should be set apart for tools of general utility, as hatchet, hammer, saw, plane, chisel, etc. The other drawers may contain corks, bladder, twine, spatulas, scoops, glass tubing, cork cutters, etc., and other articles employed in flask operations, small distillations, etc., since this counter will be used for purposes of this kind. Fig. 487 is the counter, with a sheet lead top, used for chemical work, testing, etc. It should be on the south side, so that the northern light shall fall directly upon it. A small sink at one end will be a convenience. Appropriate drawers, slides, and a closet for holding chemical apparatus are also provided. Fig. 488 represents the pharmaceutical counter, with the percolating stand (see Fig. 415) above it; two large closets to hold the percolators when not in use, and six drawers, with slides, will complete the arrangement of this counter.

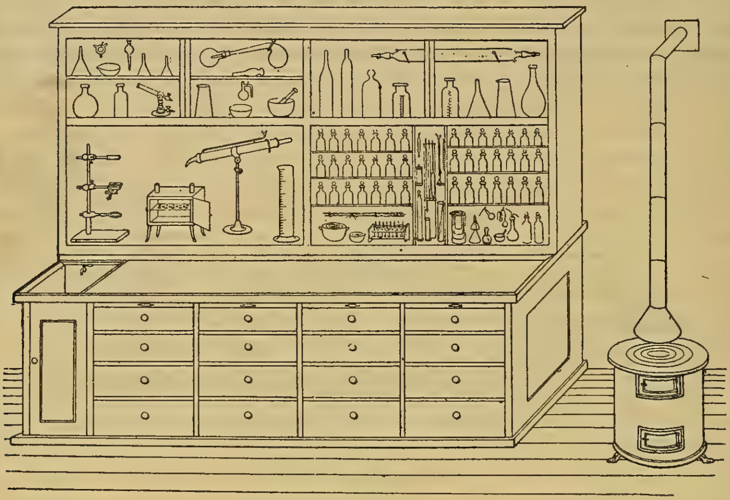
Fig. 486



Laboratory, eastern side

The Cellar.—This usually neglected locality should receive as much attention as the more favored portions of the store. It should be placed in charge of one or more of the assistants, and the responsibility for keeping it in good order definitely fixed. Good light is generally difficult to obtain, and care is necessary in the use of gas lights, lanterns, etc. The floor should be of cement, stone, or brick, and, above all, the cellar should be thoroughly drained. Good facilities for lowering and hauling heavy boxes, barrels, and packages should be provided, while the stock of prescription bottles should be kept in covered bins arranged on deep shelves, the doors being hinged from below, and each bin being distinctly labelled with the size of the bottles contained in it. In most stores the heating apparatus, whether it be a furnace or a portable heater, is located in the cellar; and the position of the heater in the cellar will largely determine the proper arrangement of the stock which is kept there. Undoubtedly the most useful feature about the cellar of a pharmacy is the fact that it affords a suitable place for keeping surplus stock, heavy or bulky articles, and those which are perishable if exposed to heat, light, or the too dry atmosphere of the upper rooms.

Fig. 487



Laboratory, southern side

The stock of mineral waters, or of liquids which are capable of freezing, should be kept near enough to the heater to prevent an accident arising from too low a temperature in winter, while ointments, cerates, volatile oils, ethereal and alcoholic liquids, etc., should be placed in the cooler portions of the cellar. If a fire proof vault made of stone or brick can be provided, it will be found a great convenience for keeping the latter class of preparations. The capabilities of the cellar should be made an object of study, and a particularly cool spot should be selected in which to keep the ointments. If this should happen to be in an inconvenient place, or too far away from the steps leading from the store, one of the stock closets in the store may be converted into a dumb waiter and lowered into a pit dug in the cellar. When an ointment is needed, the dumb waiter can be easily hauled up, secured, and, after the object is accomplished, lowered into the cooler atmosphere.

The carboys containing acids, etc., are generally regarded as cumbersome and unwieldy objects. They may be stored on skids in the least valuable portion of the cellar. The method of pouring from a carboy is by the use of Stevenson's carboy rocker (see Fig. 441).

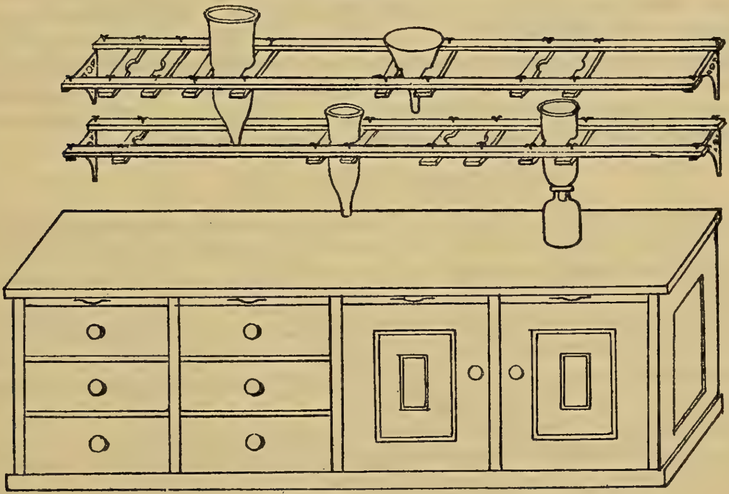
Demijohns may be protected from breakage and are conveniently used in the cellar if crated, or Banker's tilting demijohns may be used (see Fig. 489).

The custom of dispensing carbonated beverages has an advantage which is frequently overlooked,—namely, the fact that the fountains are efficient fire extinguishers. A line of gas pipe extending the whole length of the cellar, with suitable outlets, would not be an expensive investment, and yet in case of fire in the cellar it would be easy to form an attachment with a fountain of "soda-water" and thus convey a stream to the locality of the fire. The small portable steel fountains now in use would in many cases do away with the necessity for the length of gas pipe, for they could be dragged to the fire, and their contents would prove very effective if used in time.

One rule should be rigidly insisted upon in the care of the stock in the cellar, and that is that when a box of empty bottles or mineral water, or any boxed package, is opened, the contents should be distributed to the bins or places assigned for them, and the empty box and litter immediately removed.

Dampness and mould, which are generally so destructive to the stock kept in the cellar, may be avoided by ventilation. A change of air can always be secured by opening windows in the opposite ends of the cellar, and the musty odors so frequently noticed will rapidly disappear if attention is paid to ventilation.

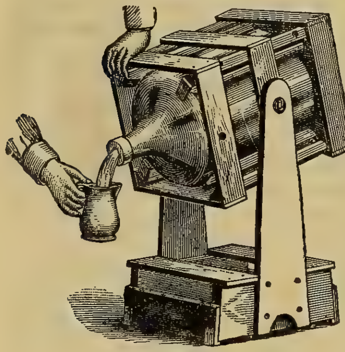
FIG. 488



Laboratory, western side

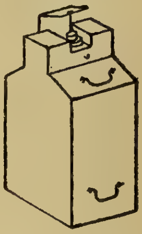
The stock of liquids is usually kept in demijohns and large green-glass bottles. These should be arranged on shelves, the larger packages on the lower shelves. The wooden covered glass demijohns and tinned iron cans, known as transportation cans and demijohns, are very useful in this connection (see Figs. 489 and 490). *Great care must be taken, however, in the use of tinned iron cans for pharmaceutical liquids.* It is not safe to store acid, alkaline, or corrosive liquids in them, nor those containing tannin, on account of their injurious action on the tinned iron. The safest plan is to limit the use of cans to oils, glycerin, alcohol, and fatty bodies, which contain nothing capable of acting on the tinned iron. The large containers should be labelled in two ways. The official name should be stencilled plainly upon the wooden side which is most prominent, and in addition there should be a tag properly labelled and tied to the handle; upon the reverse side of this tag the date showing when the contents were made, with any other useful notes or data, should be placed. The half-gallon and smaller stock bottles should be labelled distinctly with large letters. A serviceable label is made by using heavy manilla paper, and instead of an ordinary pen a camel's hair brush or a piece of pine wood whittled to a flat, stub point like a German text pen, dipped into black asphalt varnish, may be used to make the letters.

FIG. 489



Tilting demijohn

FIG. 490



Container for stock liquids

In concluding this chapter, the following rules for drug clerks are appended, they were formulated by J. B. Moore, of Philadelphia, a pharmacist of large experience and worthy attainments.

RULES FOR DRUG CLERKS[1]

Pharmacists who desire to become good and successful business men should always be on the alert, wide-awake, and observing. Watch closely the character and methods of successful business men; study human individuality; the different dispositions of people you meet in business and in your wanderings; observe the expressions on their countenances and form your opinion of their natures, characteristics, habits, tastes, etc., and study the influence of words and expressions upon your own and other minds. Think much and learn what will please and attract, also what will offend and repel.

Practise the habit of scanning the features of people who enter the store, and form an opinion of how best to pleasantly address them. Some will want you to be sociable and chatty, while others who are morose and taciturn will want but little said, and that to the point.

Remember, you have a business life ahead of you, and all this kind of knowledge is invaluable. The possession of it may also assure you success, while the lack of it may lead to failure.

The following rules will embrace almost every important act and duty of the store, and their study and observance will greatly aid you in becoming a first-class pharmacist, which every votary of the profession should aim to become. If this is not your object *you certainly have mistaken your calling.*

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[1] See Druggist's Circular, 1905, page 75.

1. **Personal Appearance.**—Clerks are expected to be well clad and present a neat and clean appearance. No one is allowed to wait upon customers in his shirt sleeves; proper respect for ladies and your own sense of propriety should forbid it.

2. **Personal Conduct.**—Avoid the use of spirituous beverages and tobacco in any form, also the offensive habit of profanity. Be truthful always.

3. We do not desire to interfere with your religious principles and inclinations, but would say that good citizenship, respect for God, and your own moral worth, should induce you, by all means, to attend divine worship once on Sunday, or at some time during the week, as your time and convenience may permit. This will tend to confer upon you a better standing, and will inspire public confidence and esteem.

4. Be particular and discriminating in the choice of your intimate associates, as your future welfare and happiness may greatly depend upon it.

5. An occasional call or short visit to the store by a friend is not objectionable, but prolonged stays, which are likely to divert a clerk's attention from his business and interfere with his duties, should not be encouraged and will not be tolerated.

6. Do not indulge in levity, loud talk, noisy conduct, whistling, singing, smoking, or other unseemly behavior in the store.

7. If necessary to ask a question of the proprietor or another clerk, go to him quietly. Do not call across the store that others may hear.

8. **Keeping up Stock.**—Be ever watchful when making a sale to notice if there remains a sufficient stock of the article sold, or that of any adjacent article; if not, make a proper minute at once upon the "want book." Every clerk and employee should be on the alert, all the time, to discover shortage in stock. Being "out of" goods called for is the bane of the business.

9. Before you place goods in stock they should be distinctly marked in ink with the cost and selling price; and later, if in handling you discover any goods unmarked, you should mark them at once, or leave them out to be marked.

10. Every day, or at leisure moments, never neglect to look after the stock of all goods that are kept in packages, bottles, boxes, etc. Also all the specialties and other goods that are put up for immediate delivery. Make a memorandum of all those that are out or nearly so, and replenish the stock at once, or at the earliest possible moment. Do not keep people, who may be in a hurry, waiting until you prepare a bottle of solution of magnesium citrate, or a seidlitz powder, or put up some other article which you ought to have ready for instant delivery. Also keep your shop bottles and shop drawers well filled. Scantily filled shop bottles suggests poverty or a lack of good business management.

11. In handling stock of any kind, either in the store, cellar, or laboratory, be careful to observe any article that has deteriorated or is becoming impaired by age, exposure, or any other unfavorable con-

dition; also, if any preparation, or any product of the laboratory, needs replenishing. Your duty and your just concern for your employer's interest should induce you to immediately report to him all such facts and circumstances.

12. The show cases, the counters, and the stock upon them should be kept clean and in order. If the cases have metal frames, these should be scoured two or three times a week and be kept bright. The cases should be wiped off every morning and dusted frequently. The contents of the cases should be kept in order, the goods changed and rearranged often to make them look fresh and attractive.

13. Avoid entirely, or as much as possible, sweeping and dusting while customers, especially ladies, are in the store.

14. In dispensing asafetida, powdered aloes, and other offensive articles, suppress as much as possible their objectionable odors, and prevent them from permeating the atmosphere of the store. In making and dispensing all offensive articles like elixir of ammonium valerianate and other valerianic preparations, and all other articles which diffuse an unpleasant smell, you should confine the work to the cellar and laboratory when practicable. The atmosphere of a pharmacy should be kept as pure and as free from all offensive odors as possible.

15. The good and desirable clerk, who aspires to a permanent position, with advancement and increase of salary, will take pride and pleasure in keeping the store in a neat and clean condition, will keep the counter show cases and all the other show cases always in order, and the stock neatly arranged and displayed in a tasteful and attractive style.

16. **Waiting on Customers.**—When a customer enters the store, greet him with a bow or a pleasant "Good morning" (or "afternoon" or "evening," as the case may be). If the customer is a lady, unaccompanied by a gentleman, and it is convenient for you to do so, accompany her to the door, and open and close it for her. These little courtesies and evidences of refinement are always appreciated.

17. If you are in the rear of the store, the sound of the door opening, or of footsteps upon the floor, should be a summons for immediate attention. Do not keep a customer waiting and wondering if any one is in. If you are out of view or deeply engaged, announce your presence, or step forward and pleasantly ask him to wait a moment; if, however, he cannot wait, endeavor to serve him at once.

18. All persons must be waited upon promptly, and the same courtesy, patience, and kindness must be shown to the smallest child and humblest citizen, irrespective of color, as is paid to the most distinguished personage. The dollars you get from them are of the same value.

19. All customers should be waited upon as nearly as possible in the order in which they entered the store. Some diffident and modest persons, especially children, may enter while you are busy and will not press forward to take their turn at the counter, and may thus be neglected. Therefore you should ever be on the alert and call or beckon to them to come forward to be waited on, otherwise they may go out offended, feeling that they have been neglected.

20. Never hastily tell a customer that you do not keep or that you are "out of" an article until you have searched for it and assured yourself by inquiring of others that it is not in stock. Then kindly offer to promptly get it for him.

21. Never be so ill-bred as to sneer or smile in derision at persons who happen to ask for an article under a wrong or distorted name. You might go just as far astray in asking for something in another kind of store.

22. Never hesitate to ask all necessary questions. This is often requisite to enable you to act intelligently in serving a customer.

23. When a customer is making known his wishes, pay strict attention to avoid the necessity of asking him to repeat his words. If a few minutes will be required to fill his order, pleasantly ask him to take a seat.

24. In waiting upon a customer, endeavor to give him your undivided attention, if possible.

25. In selling goods, especially toilet articles, perfumery, and fancy goods generally, never ask a customer what priced article he wants, nor in a miserly manner show a single article at a time; but hand out tooth-brushes by the handful, hair, nail, and other brushes, combs, perfumery, and all fancy articles in lavish quantities and pleasing variety, politely directing attention to your highest priced goods as a feeler, then successively descending the scale of prices, commenting modestly, intelligently, and instructively upon the merits of the goods, until you have met the views of your customer. Be not too importunate, and avoid offensively antagonizing his views and opinions. After a reasonable endeavor to suit, and you fail, express your regret at not being able to please him, evince no disappointment, but in a cordial and friendly manner invite him to call again. You can justly praise your best goods, but you should not speak disparagingly of your cheaper ones. Be *frank* and *honest* in what you say, and aim to suit and please your customer in what he wants.

26. After showing goods, replace them at once, or at the earliest possible moment, and properly rearrange the stock. Never allow tempting goods to lie around on the counter or show cases, where they are liable to be carried off.

27. All goods of every description, from the most insignificant to the most important, should be neatly wrapped in paper and tied with a string. If there is more than one article all should be wrapped together and made into one neat and compact package. To hand a customer a syphon of soda water, or a bottle of any of the drinking or mineral waters without wrapping it in paper, as is so often done, is a crude and slovenly style of doing business. To many fastidious persons this would be an offence against propriety which might be resented by the withdrawal of their patronage.

28. In supplying syringes or other surgical appliances, and especially to ladies, do it in the most respectful, modest, and becoming manner. Exhibit the goods at a part of the counter or other part of the store where there is the most privacy.

29. When medicines of a private nature are called for, and especially by a lady, avoid indicating by word or action that you are aware of their uses.

30. In case of any complaint, serious misunderstanding, or dispute with a customer, refer the matter at once to the proprietor, if he is in the store; or, if he is absent, be conciliatory in your manner, and reason pleasantly, making all necessary explanations, and if complete reconciliation cannot be effected, leave the matter for future adjustment by the proprietor.

31. Remember that our customers are our friends and benefactors. It is their generous patronage that gives us prosperity and enables us to provide ourselves with the necessaries and comforts, if not with the luxuries, of life. Therefore, how important it is that when a customer crosses our threshold we should greet him with every evidence of kindly welcome and extend to him every accommodation within reason to win and retain his confidence and patronage. Never treat him, as too many do, with an air of independence and indifference.

32. **Recommending Goods.**—In selling goods or medicines of any kind which are of rare and superior quality and excellence, you can with propriety modestly call your customer's attention to the fact. Many persons would be interested and pleased to know it.

33. Our specialities and goods of our own make are the most profitable, and should be given the preference when it can be done without offence. You can with propriety and often with advantage, *after the customer has made his purchase*, call his attention to and show him a similar medicine or article of our own make, speaking highly but modestly of its excellence, and at the same time saying that if the article he is getting does not cure, or is not satisfactory, you would be pleased to have him try our make, at the same time handing him a circular of the article, if you have one. But do not annoy or make an unfavorable impression upon him by importunity.

34. In selling medicines of any kind you should be frank, conscientious, and *truthful* in your statements in reference to its quality and usefulness. Never commend an article above its intrinsic therapeutic merits. Do not advise a customer to purchase a medicine of whose composition and medicinal qualities you are ignorant, nor recommend the use of a medicine whose therapeutic adaptability to the case you may question. In fact, it would rather be well to drop a word of warning and discouragement, especially to the poor and ignorant, against the purchase of a medicine, the use of which you believe may prove more harmful than beneficial. There is hardly a business in which fraud and deception can be practised with such impunity, and with so little fear of detection, as in pharmacy, and it is a bad man who would take advantage of the opportunity to practise it, where the health and the very life of the individual is involved.

35. **Stamps, Directory, Telephone, etc.**—When persons call for stamps, postal cards, etc., you should sell them all they want, or as many as can be spared, and wait upon them as promptly and courteously as if they were buying the most profitable articles.

36. Politely hand the directory to people calling to consult it, or tell them where to get it, and pleasantly answer all questions concerning its use, and, if necessary, try to find the name of anything they may be looking for and do not know how to find.

37. Be agreeable and obliging to your telephone customers; extend to them every aid you can in finding names in the telephone book;

advise them in the use of the telephone, and 'phone for them if you have time and if they request it, or do not understand how to use the instrument.

38. Willingly accommodate persons calling for change, whether customers or not, and manifest pleasure in serving them. These little accommodations cost us nothing and occasion slight trouble, and often confer a great service in time of need, and are generally appreciated by the public and redound to our credit and promote our success in business.

39. Persons stepping into the store to wait for a car or for any other purpose should be politely and pleasantly invited to take a seat, and by your cordial manner made to feel that they are welcome.

40. When persons call to inquire about *anything*, answer in the most courteous and agreeable manner, giving them the fullest information possible, even if it puts you to some trouble. This may often make a friend and future customer, while a rude and discourteous reply is apt to make you an implacable enemy.

41. **In the Prescription Department.**—When a person hands you a prescription, do not stand in his presence and ponder over it as though you did not understand it. Politely thank him and invite him to be seated, and at once go behind the prescription counter, where you can critically examine it.

42. In refilling prescriptions you must see that all soiled containers are thoroughly cleaned, a new label is affixed, and, in the case of a bottle, a new cork is used, making the package as fresh looking as when new. All labels must be neatly and distinctly written and carefully applied.

43. All pill masses should be carefully made. Proper excipients should be chosen and so cautiously and carefully added as to give the pill sufficient firmness to retain its shape on standing without the addition of any absorbent powder to stiffen it, and which unnecessarily augments its size. When the ingredients are mixed and ready for the excipient, if doubt exists as to the best one, it will be well to experiment with several small portions of the mixture to ascertain the best excipient, then mix all together and go ahead. This may often save you much trouble.

44. In compounding liquid medicines, all crystalline salts and all solid substances of tardy or sparing solubility, or that are insoluble in the liquid ingredients of a mixture, should first be reduced to the finest possible state of division in a mortar before admixture. They should not simply be thrown into the bottle to be shaken up with the liquid ingredients, perhaps to deposit and remain in coarse particles, to the disgust of the patient and to mar the appearance of the mixture. You have no right to strain out any insoluble *medicinal* ingredient. Physicians never add any ingredient that they do not want retained in the mixture. When you have reduced the solid material to the utmost fineness, you have done your duty. Put a "shake well" label on the bottle of all mixtures containing insoluble matter, and if the deposit is of much potency, also verbally call attention to the importance of shaking the medicine well before taking. You must in such cases sacrifice beauty and elegance to medicinal efficiency. Look through and examine all mixtures and remove any

visible specks or other accidental impurities. It is well to pass all suspected mixtures through a fine tea strainer, which I consider an indispensable adjunct to the prescription counter.

45. In dispensing powders, after the ingredients are all thoroughly mixed, to insure greater uniformity, elegance, and purity, the mixed powder should be passed through a No. 80 sieve, and the coarse particles should be returned to the slab or mortar for further trituration and repeated sifting until the process is completed, when the powder should be again thoroughly mixed and then dispensed as directed.

46. All mortars, graduates, spatulas, and utensils whatsoever, employed in filling prescriptions and in the manufacture of preparations, should be washed, cleaned, and put away where they belong immediately after use. All shelf bottles and all bottles and containers brought from the cellar or elsewhere to supply a portion of their contents, should likewise be at once returned to their proper places and not allowed to remain on the counter or floor. The sponges used at the prescription counter and sink should be frequently washed with soap and ammonia water to keep them clean. Do not leave them lying about the counter or in the sink, foul and filthy, as is too often done.

47. Be sure to cork all bottles carefully and well, especially those containing medicine dispensed on prescription. Select corks of good quality and proper size. After properly pressing them, gently force and adjust them into the neck of the bottle to about one-third their length, or sufficient to give a firm fixedness, leaving enough of the cork projecting for convenient handling.

48. All errors in compounding prescriptions, in dispensing or in the delivery of prescriptions or medicines of any kind, should be at once reported to the proprieter; for by his prompt, intelligent, and timely action he may frustrate, avert, or at least modify any evil consequence.

49. **Charging Goods.**—When goods are to be charged, no duty, however important, must prevent the clerk from charging them at once or filing a memorandum. No one can estimate the loss to retail dealers each year on account of neglect of this precaution.

50. In the absence of the proprietor and his manager, refrain from opening new accounts with persons of doubtful or unknown responsibility, and abstain from augmenting long-standing, unpaid accounts. The clerk can generally, with grace and without offence to any honest person, decline by politely saying, "I am extremely sorry, but in the absence of the proprietor I cannot assume the responsibility of selling goods on credit." Of course, if you believe the person to be responsible, and the account is small, you might, to avoid delay and possible offence to a good customer, accommodate him and report the transaction at the earliest opportunity.

51. A clerk or employee who desires any article out of the stock of the store, should not take it surreptitiously,—that is, without the knowledge of the proprietor or his manager. Whether he pays for it or not, such a transaction is questionable and reprehensible. He should make his wants known to the proprietor, preferably, or to his manager, who may accede to the request, adjust the price and terms of sale. If the goods are charged, payment should be made to the

proprietor or manager. This is the only proper and honorable course to pursue. It protects the reputation of the clerk and inspires confidence in his integrity.

52. **Using the Cash Register.**—In using the cash register, all registrations must be so made as to indicate the full amount of the sale. Intentional and persistent infractions of this rule will insure summary discharge.

53. **Sending out Goods.**—There must positively be no unnecessary delay in despatching all goods for which orders have been left or sent, whether haste has been requested or not. Nothing more injuriously affects the business character of a store than habitual tardiness in the delivery of goods, and especially if they be prescriptions, when, perhaps, a sick and nervous person may be waiting in intense and feverish anxiety. When an unavoidable cause has occasioned delay, a proper apology or explanation should be made in writing or verbally upon the delivery of the goods. Promptitude in business establishes confidence, is characteristic of a good pharmacist, and is a potent factor in his business success.

54. **Poisons.**—You must exercise great care and caution in selling poisonous, strongly caustic, and highly irritating or corrosive substances. They should be carefully and correctly labelled, and also with the word "poison." The purchaser should be cautioned as to their dangerous character, and all necessary verbal precautionary directions for their use and keeping should be given to awaken attention and emphasize their noxious nature. A correct registration of the sale of the article should always be made in compliance with the poison law of the State.

55. **Answering the Night Bell.**—The night bell must be promptly and pleasantly answered. It is one of the inseparable and disagreeable features of the business. But for consolation, imagine it is yourself at the door, suffering with cramp-colic, a hemorrhage, or some other painful or dangerous malady, seeking relief, or with a prescription to be renewed for a sick mother, wife, child, or other dear one lying at the point of death, and I know your wrath will be appeased and you will pardon your untimely caller.

56. **The Soda Counter.**—Everything pertaining to the soda fountain should be kept in order and scrupulously clean; glasses, spoons, etc., should be washed immediately after being used. A sloppy soda counter, with glasses, tumbler holders, spoons, etc., strewn about in confusion and in a dirty condition, together with soiled napkins and old straws, is repulsive and disgusting to customers, and bespeaks laziness and slovenliness. Dirty glasses and spoons should not be allowed to remain in the sink. The soda apparatus should be washed daily, and the draught tubes, syrup faucets, and the other metal parts should be scoured frequently. The towels and sink should also be kept clean. The sponge should be washed daily, or oftener, with soap and ammonia water, and thoroughly rinsed. The supply of syrups and their condition should be objects of solicitude and daily inspection. Discard at once all syrups that are not in prime condition. Being "out of" any of the usual syrups when they are called for makes a bad impression. The beverages should be drawn with care. Syrups and other admixtures should be well mixed and not allowed

to remain in the bottom of the tumbler to be drunk at the last swallow, as is often the case. In dispensing ice cream soda first mix the syrup and soda water thoroughly with a spoon before adding the ice cream.

57. **General Guide to Work.**—Every act in pharmacy should be performed with care, thoughtfulness, intelligence, and the greatest accuracy. Your own liberty and the lives of your customers depend upon it. Do nothing that does not receive the sanction of your conscience and your best judgment. Be ever mindful of the old adage: "Be sure you are right, then go ahead."

58. The opening and closing of doors and drawers, and the handling of utensils should be done as noiselessly as possible; especially avoid the clanging of the pestle against the sides of the mortar, which is so trying to the nerves of delicate and sensitive people. In fact, every movement about a pharmacy should be made as silently as possible. Quietude is characteristic of a first-class pharmacy.

59. Always carefully and accurately weigh and measure everything you sell or use, and acquire the habit of wrapping and tying packages neatly and tastefully. At the prescription counter weigh and measure with the greatest accuracy. See that your prescription scales are clean and accurately balanced and always wipe the balance pans after using. Take pride in learning to fold powders with care, neatness, and the greatest uniformity.

60. Be ever watchful and never sell a bottle of solution of magnesium citrate that is cloudy or contains an unsightly flocculent or solid precipitate; nor any medicinal syrup in fermentation, or otherwise in bad condition; nor any tincture or other liquid preparation which is avoidably cloudy or containing any unmedicinal precipitate until it has been filtered; nor oatmeal, orris root, or other vegetable powder, ground or unground, inhabited by worms or insects. In fact, you should sell no article that has so visibly deteriorated as to impair or destroy its usefulness. The reputation of any pharmacy will depend largely upon the rigid observance of this rule.

61. We do not expect, nor do we desire, our clerks to be mere machines. We wish them to be wide awake, thoughtful, experimental within proper bounds, studious, and observing. If they are ambitious, apt, inventive, ingenious, and practical, and seek to learn, they may, in their daily practical experience in the prescription department and the laboratory, conceive, develop, and discover many new ideas and better methods. To this end there is a wide field open in the preparation of the various peculiarly difficult and unusual mixtures, emulsions, capsules, intractable pill masses, troublesome ointments, etc., also in the extemporaneous manufacture of some galenical and chemical preparations which put to the test the tact, skill, and ingenuity of the most experienced manipulator. They may also be able to offer useful suggestions in the dressing of windows, the arrangement of stock in the show cases, in the store generally, and also in the cellar, and in other matters connected with the business. Aspirations and achievements of this kind will be appreciated and encouraged. All such well matured ideas and suggestions will receive our most cordial consideration, and, if approved, will merit our hearty commendation and their adoption.

62. "It is a wise man who knows what to do next." Never commence to do anything that is not required to be done for a day or more, when your last of some package goods, a bottle of one of your specialties, or other preparation which is liable to be called for at any moment, has been sold.

63. Honor and loyalty should also prompt you to report at once all mistakes in the manufacture of preparations, all breakage of glassware or other valuable articles; loss or damage to valuable material or stock; any occurrence that involves pecuniary loss; or any circumstance which is calculated to injure the reputation of the store or the interests of its proprietor. Such creditable evidences of honesty and frankness will elevate you in the confidence and esteem of your employer, while the suppression and concealment of such knowledge might justly lead to your discharge.

64. Store secrets and all private matters connected therewith should be held sacred and inviolate. The clerk who would divulge them is disloyal, and should be deemed unworthy to hold a position in any respectable pharmacy.

A Word of Advice.—Every clerk should take pride in acquiring and cultivating a kind and amiable disposition and the habit of working quickly and well.

Intelligent, quick, careful, honest, and good workers, who are polite and obliging, are "jewels," and they are always in demand at good salaries. People in a hurry will wait with patience for attention from an energetic and hustling clerk when they see he is doing his best. Besides, he inspires confidence and good will.

Avoid the habit of changing positions for trifling reasons. When you are fairly paid for your services, and opportunities are good for acquiring knowledge of your business, do not leave. Hard work will not hurt you. Shifting and idleness will. Really good clerks seldom change positions. The wanderer is always on the go, and he is the bane of the business, both to himself and to his employer. Strive to please your employer and your position will be assured. Sensible men seldom change clerks without substantial reasons. Do not listen too much to the persuasion and advice of others. Be true to yourself, honest, and loyal; do your duty and you will have nothing to fear. Remember there are counter-balancing objections to almost any new position. Many have painfully regretted the changes they have unwisely made.

CHAPTER LXIV

PRESCRIPTIONS

THE word prescription is derived from the Latin word *præscriptio* (*præ*, "before," and *scribo*, "I write"). It may be defined as the formula which a physician writes, specifying the substances he intends to have administered to a patient.

The Latin language is preferred here in writing prescriptions, as it is also in Great Britain, Germany, and other European countries. The advantages of the use of Latin in designating the ingredients of the prescription are obvious: 1. It is the language of science, and is understood, to a greater or less extent, throughout the civilized world. 2. It is a dead language, and therefore not subject to the changes that are common to all living forms of speech. 3. The Latin names for medicines are distinctive, and very nearly the same in all countries. 4. It is frequently necessary, and always advisable, to withhold from a patient the names and properties of the medicinal agents administered. This can usually be effected by the use of the Latin technical terms.

The Parts of a Prescription.—For the purpose of examination or study a model prescription may be divided into six parts: 1. *The superscription, or heading.* 2. *The name of the patient.* 3. *The inscription, or the names and quantities of the ingredients.* 4. *The subscription, or the directions to the compounder.* 5. *The signa* (*mark*), *or the directions for the patient.* 6. *The name or initials of the physician, with the date.*

1. **The Superscription, or Heading.**—This invariably consists, in Latin prescriptions, of the symbol ℞, which is an abbreviation of the word *recipe* ("take"), the imperative of the Latin verb *recipio*. In French prescriptions the letter *P*, the initial letter of the word *prenez* ("take"), is used.

The use of the inclined stroke upon the tail of the ℞ is traced to a custom, common in the ancient days of superstition, of placing at the top of the prescription an abbreviation, called an invocation, which represented a prayer to a favorite deity. The sign of Jupiter (♃), the chief mythological divinity of the ancient Romans, was usually employed. This was gradually replaced by the letter R; but the last stroke of the symbol of the all-powerful Jove has not yet been surrendered, and it remains as an ornament to the superscription to the present day.

2. **The Name of the Patient.**—This is frequently omitted from the prescription through inattention. It should always be placed at the top of the prescription, and should be transferred to the label by the compounder. Serious accidents have sometimes occurred through neglect of this direction, as when an adult dose of a medicine has been given to a child, owing to the similarity of the appearance of an

adult's and a child's medicine, and the name of the patient not appearing on either label.

3. The Inscription, or the Names and Quantities of the Ingredients.—This part of the prescription is undoubtedly the most important of all, and requires the greatest amount of care. The official title (see page 29) of the ingredients should always be used for designating those which are official. A model prescription, if it is of the compound class, is presumed to embrace the following: 1. The *basis*, or chief active ingredient. 2. The *adjuvant*, or aid to the basis, to assist its action. 3. The *corrective*, which is intended to qualify the action of the basis and adjuvant. 4. The *vehicle*, the ingredient which serves to "carry all," or hold them together, dilute them, and give to the whole the proper consistence, form, and color. This is sometimes called the *diluent.*

The ingredients are sometimes written down by the physician in the order given above; but this rule is frequently deviated from, and they follow in the order of their importance. This is a matter of small moment to the pharmacist, however, for he always has to consider solubility, compatibility, and other necessary considerations which determine the order, if the prescription is to be compounded properly.

Many prescriptions contain but one or two ingredients, there being no especial need of a corrective, vehicle, or diluent, the tendency of modern therapeutics being against polypharmacy and in the direction of simple and concentrated remedies, or those having positive effects. There are many advantages to be derived, however, from the combination of ingredients, even when these have similar medicinal action.

The name of each ingredient, and the quantity attached to it, should occupy but one line, and great care should be observed in abbreviating, to see that the abbreviation is distinctive and not liable to be mistaken for an article not intended by the writer. The cabalistic characters in present use, designating the quantities in a Latin prescription, must be very plainly written, if serious errors are to be avoided.

The method of ascertaining the quantities of each of the ingredients generally followed by physicians, is first to write down the names of the ingredients in the proper order, each on a separate line, without affixing the quantities; then having decided upon the total number of doses that are to be given, or the total number of pills, lozenges, capsules, suppositories, etc., by multiplying this by the amount proper to give for the single dose the quantity of the ingredient is obtained.

Method of allotting Quantities

Parts in Order	℞ Ingredients	No. of Doses	Multiplied by	Single Dose	Quantity of each Ingredient
Basis	Chloralis	16	×	7½ gr.	ʒii
Adjuvant	Potassii Bromidi . . .	16	×	15 gr.	℥iv
Corrective	Syrupi Zingiberis . . .	16	×	fʒss	f℥i
Vehicle	Syrupi	16	×	fʒiss	f℥iii

Symbolic Characters used in Latin Prescriptions.—Although the subject of weights and measures is treated in the earlier chapters of this work, the special characters used in prescriptions, with their values attached, may be appropriately recalled in this connection. They are as follows:

♏, *Minim*, $\frac{1}{60}$ of a fluidrachm
gtt., *Gutta*, a drop; plural, *guttæ*, drops
gr., *Granum*, a grain; plural *grana*, grains
ss., *Semis*, a half
℈, *Scrupulus*, a scruple (20 grains)[1]
ʒ, *Drachma*, a drachm (60 grains)
fʒ, *Fluidrachma*, a fluidrachm (60 minims)
℥, *Uncia*, a troyounce (480 grains)
f℥, *Fluiduncia*, a fluidounce (8 fluidrachms)
℔, *Libra*, a pound, rarely used in prescriptions (5760 grains)
O, *Octarius*, a pint (16 fluidounces)

The Roman numerals are used to designate quantities,—i, ii, iii, iv, v, vi, vii, viii, ix, x, xx, xxx, xl, l, lx, lxx, lxxx, xc, c, etc. These are always written after the ingredient, as Sacchari ʒiv. Care should be taken to dot the i's in each case, to avoid possible errors. The "j" is sometimes used in place of "i" where more than one i is needed at the end of the quantity; thus, "gr. ij," meaning two grains. The "j" is oftener written like an elongated "i;" thus, "ij."

4. **The Subscription, or the Directions to the Compounder.**—The progress made in pharmacy is well shown by the present custom of omitting specific directions to the compounder. In the vast majority of prescriptions the subscription is contracted to a single letter or word, as *M.*, or *misce*, *S.*, or *solve*, *F.*, *fiat*, etc. The physician relies upon the skill of the pharmacist, and generally gives no specific directions.

5. **The Signa, or Directions for the Patient,** sometimes called Signatura, is usually abbreviated *Sig.* or *S.* Formerly these directions were written in Latin, but this is rarely the case now, except in Great Britain. There is, indeed, no good reason for writing them in Latin. The Latin which is in common use in prescription writing is idiomatic, and, although the ordinary rules of Latin grammar are generally applicable to it, many of the terms have a special meaning, and it differs in several respects from classical Latin, and hence has to be a special object of study. The directions should be known to the patient, and should be written in the vernacular on the label in a clear, distinct hand. The careless habit of not specifying the directions, by writing "As dir." for "As directed" or "Use as directed," is greatly to be deprecated. Frequently the patient forgets the verbal directions, or misunderstands them, and asks the pharmacist, "How is this medicine to be taken?" The answer must of necessity be as worthless as the direction, unless the pharmacist by skilful questioning can cause the directions to be recalled by the patient. Then, again, the dose of the prescription gives the only clue to its safety. Without knowing it, the pharmacist cannot be held responsible for not detecting an error. The patient, even if he remembers at the time the verbal directions, may soon forget them, and afterwards take

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[1] This weight is rapidly passing out of use. It is quite as convenient to write gr. xx, and this is not likely to be mistaken for ʒ, as ℈ is.

a double dose by mistake. The directions for the patient should be written in full, explicitly, and in plain English.

6. **The Name or Initials of the Physician, with Date.**—The name of the prescriber is rarely signed in full, particularly since the very general use of printed prescription blanks, which contain not only the full name and address of the physician but also his office hours. It is very necessary sometimes to communicate quickly with the physician in case of error or ambiguity, and, when printed blanks are not used, the name and address of the prescriber should be written in full.

Unusual Doses in Prescriptions.—It is to be regretted that some uniform system of indicating unusual doses has not been adopted by physicians. Occasions frequently arise where the patient, either from becoming habituated to its use, or from some other cause, will tolerate an excessive or ordinarily poisonous dose of a remedy. A careful pharmacist always hesitates to compound such a prescription if the dose is not especially marked as unusual, and delays necessarily occur. The most satisfactory method of indicating such a dose is that of underscoring the quantity deemed unusual, as shown in the following:

℞ Morph. Sulph. $\underline{\text{gr. vi}}$
Syrup. Limonis fʒii
Aquæ q. s. ft. f℥i.
Sig. A teaspoonful every two hours until relieved.

Other marks are sometimes used,—the exclamation mark (!), for instance, or Q. R. (*quantum rectum*). These are not so distinctive as underscoring, and are open to the objection that in handwriting, which is very apt to be defective, they are likely to puzzle or mislead the pharmacist by being mistaken for some other parts of the prescription. A heavy black line under the unusual dose cannot be mistaken.

One of the best works published upon prescription Latin is the Latin Grammar of Pharmacy, by Joseph Ince, London. The student will be well repaid by a careful perusal. The following Latin prescription from Whitla's Elements, with the grammatical analysis, is so thoroughly illustrative that it is inserted almost in its entirety:

℞	. . . .	SUPERSCRIPTION
(Basis.)	*Pot. Acet.* ʒv.	INSCRIPTION
(Adjuvant.)	*Tinct. Digitalis* fʒi.	
(Corrective.)	*Syr. Aurantii* f℥i.	
(Vehicle.)	*Decoct. Scoparii ad* f℥viii.	
M., ft. mist.	. . . .	SUBSCRIPTION
Cpt. cochl. mag. ii. 4ta q.q. hora ex paul. aquæ.		SIGNA

Without abbreviations or contractions it would read thus:

Recipe
Potassii Acetatis drachmas quinque.
Tincturæ Digitalis drachmam unam.
Syrupi Aurantii unciam unam.
Decocti Scoparii ad uncias octo.
Misce, fiat mistura. Capiat cochlearia duo magna quartâ quâque horâ ex paululo aquæ.

The student will find benefit from a careful study of the following page, in which the Latin of the above prescription is arranged according to the English idiom, and each word parsed and translated.

Recipe Potassii Acetatis drachmas quinque

℞ (Recipe)	v. irr. tr. imp. m. 2d per. s., to agree with its nom. Tu—"thou" (understood). Recipi-o, recepi, receptum, recipere. From re and capio.	Take thou
v (quinque)	num. adj. indec. ac. pl. qual. and agreeing with drachmas.	five
ʒ (drachmas)	n. f. ac. pl. Drachma, -æ.	drachms.
Acet. (acetatis)	n. f. gen. s. qual. drachmas. Acetas, -atis.	of acetate
Pot. (potassii)	n. f. gen. s. qual. acetatis. Potassium, -ii	of potash

Recipe Digitalis Tincturæ drachmam unam

℞ (Recipe)	(understood.)	Take thou
i (unam)	num. adj. ac. s. qual. and agreeing with drachmam. Unus, -a, -um.	one
f ʒ (drachmam)	n. f. ac. s. gov. by recipe. Drachma, -æ.	drachm.
Tinct. (tincturæ)	n. f. gen. s. qual. drachmam. Tinctura, -æ.	of the tincture
Digit. (digitalis)	n. f. gen. s. qual. tincturæ. Digitalis, -is.	of digitalis

Recipe Aurantii Syrupi unciam unam

℞ (Recipe)	(understood.)	Take thou
i (unam)	(Parsed as before.)	one
f ℥ (unciam)	n. f. ac. s. gov. by recipe. Uncia, -æ.	ounce
Syr. (syrupi)	n. m. gen. s. qual. unciam. Syrupus, -i.	of syrup
Aur. (aurantii)	n. neut. gen. s. qual. syrupi. Aurantium, -ii.	of orange peel

Recipe Decocti Scoparii ad uncias octo

℞ (Recipe)	(understood.)	Take thou
Ad.	prep. used adverbially.	up to
viij (octo)	num. adj. indec. qual. uncias.	eight
f ℥ (uncias)	n. f. ac. pl. gov. by recipe. Uncia, -æ.	ounces
Decoct.[1] (decocti)	n. neut. gen. s. qual. uncias. Decoctum, -i.	of the decoction
Scop. (scoparii)	n. masc. gen. s. qual. decocti. Scoparius, -ii.	of broom

Misce, fiat mistura

M. (misce)	v. trans. imp. m. p. t., agreeing with and governed by Tu (understood). Misceo, -ui, mixtum or mistum, miscere.	Mix you, or mix
Mist. (mistura)	n. f. nom. s., governing fiat. Mistura, -æ.	Let the mixture
Ft. (fiat)	v. used as passive of facio, pres. sub. 3d s. Used as imp. gov. by and agreeing with mistura. Fio, factus sum, fieri; to be made or become.	be made

Capiat cochlearia duo magna quartâ quâque horâ ex paululo aquæ

Cpt. (capiat)	irr. v. tr. sub. m. pr. t. 3d per. s., agreeing with and gov. by Is—"he" (understood). Capio, cepi, captum, capere, the present subjunctive used as an imperative.	He may take, or let him take
ii (duo)	num. adj. ac. pl. neut. qual. and agreeing with cochlearia. Duo, -æ, -o.	two
Mag. (magna)	adj. ac. pl. neut. qual. and agreeing with cochlearia. Magnus, -a, -um.	large
Coch. (cochlearia)	n. ac. pl. neut., gov. by capiat. Cochleare, -is.	tablespoonfuls
q.q. (quâque)	pron. indef. abl. s., qualifying and agreeing with horâ. Quisque, quæque, quodque.	at each
4*ta* (quarta)	num. adj. abl. s., qualifying and agreeing with horâ. Quartus, -a, -um.	fourth
Horâ	n. f. abl. s. Hora, -æ.	hour
Ex.	prep.	out of
Paul. (paululo)	adj. abl. s. Used as a noun, gov. by ex. Paululus, -a, -um.	a little
Aq. (Aquæ)	n. f. gen. s. qual. paululo. Aqua, -æ.	of water

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[1] Some authorities would put Decoct. in the accusative, governed by recipe. In the same way, where the student meets Aquæ ad f℥ in the different prescriptions and formulæ throughout this work, he may substitute Aquam ad f℥; but this latter is by no means so idiomatic as Aquæ ad f℥.

Abbreviations are necessary in writing prescriptions, and they are universally employed. Great care must be taken, however, to avoid ambiguities, which may mean *death to the patient.* Usually, the careful pharmacist gathers from the directions and the quantities the information which guides him safely. A few examples of defective abbreviations are appended, a number of which are taken from Pareira's Physician's Prescription Book.

Acid. Hydroc.	May mean Acidum Hydrochloricum or Acidum Hydrocyanicum
Aconit.	Aconitina Aconiti Radix Aconiti Folia
Ammon.	Ammonia (alkali) Ammoniac (gum resin)
Aq. Chlor.	Aqua Chlori Aqua Chloroformi
Aq. Fontis.	May often be read Aqua Fortis
Calc. Chlor.	Calcium Chloride Chlorinated Lime
Chlor.	Chlorine Chloroform Chloral
Emp. Lyt.	Emp. Lytharg. (lead plaster,—old name) Emp. Lyttæ (blistering plaster
Ext. Col.	Extractum Colchici Extractum Colocynthidis
Hyd. Chlor.	Calomel Corrosive Sublimate Hydrated Chloral
Hydr.	Hydrargyrum (mercury) Hydras (hydrate) Hydriodas (hydriodate) Hydrochloras (hydrochlorate) Hydrocyanas (hydrocyanate)
Hydr. Perox.	Hydrogen Peroxide Hydrargyri Peroxidum
Mist. Ammon.	Ammonia Mixture Mixture of Ammoniac (gum resin)
Potass. Hyd.	Potassium Hydrate (caustic potassa) Potassium Hydriodate (potassium iodide)
Sod. Hypo.	Sodium Hyposulphite Sodium Hypophosphite
Sod. Sulph.	Sodium Sulphate Sodium Sulphite Sodium Sulphide
Sulph.	Sulphur Sulphide Sulphate Sulphite
Zinci. Phosph.	Zinc Phosphate Zinc Phosphide

The above list might be indefinitely prolonged. Sufficient has been clearly shown, however, to convince even the most sceptical practitioner of the grave danger of careless abbreviation. The following table of abbreviations, terms, etc., used in prescriptions will be of service to the pharmacist, by enabling him to translate some of the technical phrases used in writing prescriptions :

Word or Phrase	Contraction	Meaning
A, āā	. . . . . .	Of each
Ablutio	. . . . . .	A washing
Absente febre	Abs. febr.	In the absence of fever
Accuratissime	Accuratiss	Most carefully
Acerbus	. . . . . .	Sour
Ad	Ad	To, up to
Ad conciliandum gustum	. . . . . .	To suit the taste
Ad defectionem animi	Ad def. animi	To fainting
Adde, addantur, addendus, addendo	Add.	Add, or let them be added, to be added, by adding
Ad duas vices	Ad 2 vic.	At twice taking
Ad gratam aciditatem	Ad grat. acid.	To an agreeable sourness
Adhibendus	. . . . . .	To be administered
Ad libitum	Ad lib.	At pleasure
Admove, admoveatur, admoveantur	Admov.	Apply, let it be applied, let them be applied
Ad partes dolentes	Ad part. dolent.	To the painful parts
Ad secundum vicem	. . . . . .	To the second time
Adstante febre	Adst. febre	When the fever is on
Ad tertiam vicem	. . . . . .	For three times
Adversum	Adv.	Against
Ætas	. . . . . .	Age, time of life
Aggrediente febre	Aggred. febre	While the fever is coming on

Word or Phrase	Contraction	Meaning
Agita	Agit.	Shake, stir
Agitato vase	. . . . . .	The vial being shaken
Albus	Alb.	White
Alcoholizatus	. . . . . .	Alcoholized, finely powdered
Aliquot	. . . . . .	Some, a few
Alter	. . . . . .	The other
Alternis horis	. . . . . .	Every other hour
Aluta	. . . . . .	Leather
Alvo adstricta	Alv. adst.	The bowels being confined
Alvus	. . . . . .	The belly
Amplus	. . . . . .	Large
Ana	A., āā.	Of each
Ante	. . . . . .	Before
Aqua aërata	Aq. aërat.	Carbonated water
Aqua astricta	Aq. astr.	Frozen water
Aqua bulliens	Aq. bull.	Boiling water
Aqua communis	Aq. comm.	Common water
Aqua fervens	Aq. ferv.	Hot water
Aqua fluviatilis	Aq. fluv.	River water
Aqua fontalis (or fontis or fontana)	Aq. font.	Spring water
Aqua marina	Aq. mar.	Sea water
Aqua nivalis	Aq. niv.	Snow water
Aqua pluviatilis (or pluvialis)	Aq. pluv.	Rain water
Aut	. . . . . .	Or
Baccillum	. . . . . .	A bougie
Balneum arenæ	B. A.	Sand bath
Balneum mariæ or maris	B. M.	A salt water bath
Balneum vaporosum or vaporis	B. V.	A vapor bath
Barbadensis	B.B., B.B.S.	Barbadoes
Bene	. . . . . .	Well
Bibe	Bib.	Drink
Biduum	. . . . . .	Two days
Bis	. . . . . .	Twice
Bis in die	Bis in d.	Twice a day
Bis in dies	Bis in d.	Twice a day
Bolus	Bol.	A large pill
Bonus	. . . . . .	Good
Brevis	. . . . . .	Short
Bulliat, bulliant	Bull.	Let boil
Butyrum	But.	Butter
Calefactus	. . . . . .	Warmed
Capiat	Cap.	Let him (or her) take
Capsulæ amylaceæ	. . . . . .	Starch capsules,—*i.e.*, cachets
Carbasus	Carbas.	Lint, linen
Caute	. . . . . .	Cautiously
Charta	Chart.	Paper
Charta cerata	Chart. cerat.	Waxed paper
Chartula	. . . . . .	Small paper
Cibus	. . . . . .	Food
Cito dispensetur	Cito disp.	Dispense quickly
Cochlear or cochleare, Cochleatim	Coch., Cochleat.	A spoonful, by spoonfuls
Cochleare amplum	Coch. amp.	A tablespoonful
Cochleare magnum	Coch. mag.	A large spoonful (about half an ounce)
Cochleare medium or modicum	Coch. med.	A dessertspoonful (about two fluidrachms)
Cochleare parvum	Coch. parv.	A teaspoonful (about one fluidrachm)
Coctio	Coct.	Boiling
Cœruleus	Cœrul.	Blue
Cogantur	. . . . . .	Let them be combined
Cola	Col.	Strain
Colaturæ	Colatur.	To, or of, the strained liquor
Colatus	Colat.	Strained
Colentur	Colent.	Let them be strained
Coletur	Colet.	Let it be strained
Collunarium	. . . . . .	A nose wash
Collutorium	Collut.	A mouth wash
Collyrium	Collyr., Coll.	An eye wash
Coloretur	. . . . . .	Let it be colored
Commisce	. . . . . .	Mix together
Compositus	Comp.	Compounded
Concisus	. . . . . .	Cut
Concussus	. . . . . .	Shaken
Confectio	Conf.	Confection
Confricamentum	. . . . . .	A liniment
Congius	Cong.	A gallon
Conquassando	. . . . . .	Vigorous shaking
Conserva	Cons.	A conserve; also keep (thou)
Consperge	Consperg.	To dust or sprinkle
Contere	. . . . . .	Rub together
Continuantur remedia	Cont. rem.	Let the medicines be continued
Contra	. . . . . .	Against
Contusus	. . . . . .	Bruised
Coque, Coquantur	Coq.	Boil, let them be boiled
Coque ad medietatis consumptionem	Coq. ad. med. consump.	Boil to the consumption of half
Coque in sufficiente quantitate aquæ	Coq. in S. A.	Boil in a sufficient quantity of water
Coque secundum artem	Coq. S. A.	Boil according to art
Cor, cordis	. . . . . .	The heart
Cortex	Cort.	The bark
Cotula	. . . . . .	A measure
Coxa	. . . . . .	The hip
Cras, Crastinus	Crast.	To-morrow
Cras mane sumendus	. . . . . .	To be taken to-morrow morning
Cras nocte	. . . . . .	To-morrow night
Crastinus	. . . . . .	For to-morrow, early

Word or Phrase	Contraction	Meaning
Cras vespere	. . . . . .	To-morrow evening
Cujus, Cujuslibet	Cuj.	Of which, of any
Cum	C.	With
Cyatho theæ	. . . . . .	In a cup of tea
Cyathus, or Cyathus vinarius	Cyath., C. vinar.	A wineglass (from one-half to two fluidounces)
Da, detur	D., det.	Give, let be given
De	. . . . . .	Of, or from
Deaurentur pilulæ	Deaur. pil.	Let the pills be gilded
Debita spissitudo	Deb. spiss.	A proper consistence
Debitus	. . . . . .	Due, proper
Decanta	Dec.	Pour off
Decem, Decimus	. . . . . .	Ten, the tenth
Decubitus	Decub.	Lying down
De die in diem	De d. in d.	From day to day
Deglutiatur	Deglut.	May or let be swallowed
Dein	. . . . . .	Thereupon
Dejicerit	. . . . . .	Let it be purged
Dentur tales doses No. iv	D. t. d. No. iv	Let four such doses be given
Detur in duplo	. . . . . .	Let twice as much be given
Dexter, Dextra	. . . . . .	The right
Diebus alternis	Dieb. alt.	Every other day
Diebus tertiis	Dieb. tert.	Every third day
Digere	. . . . . .	Digest
Diluculo	Diluc.	At break of day.
Dilue, Dilutus	Dil.	Dilute (thou), diluted
Dimidius	Dim.	One-half
Directione propriâ	D. P. or direc. prop.	With a proper direction
Dividatur in partes æquales	D. in p. æq.	Let it be divided into equal parts
Dividendus, -a, -um	. . . . . .	To be divided
Dolor	. . . . . .	Pain
Donec	. . . . . .	Until
Donec alvus bis dejiciatur	. . . . . .	Until the bowels have been twice evacuated
Donec alvus soluta fuerit	. . . . . .	Until the bowels shall be opened
Donec dolor nephriticus exulaverit	. . . . . .	Until the nephritic pain is removed
Durante dolore	. . . . . .	While the pain lasts
Eadem (fem.)	. . . . . .	The same
Eburneus	Eburn.	Made of ivory
Edens	. . . . . .	Eating
Edulcorata	Ed.	Edulcorated
Ejusdem	Ejusd.	Of the same
Electuarium	Elect.	An electuary
Emulgens	. . . . . .	An emulsifying agent
Enema	En.	An enema, a clyster

Word or Phrase	Contraction	Meaning
Enemata	. . . . . .	Clysters
Epistomium	Epistom.	A stopper
Et	. . . . . .	And
Etiam	. . . . . .	Also, besides
Evanuerit	. . . . . .	Shall have disappeared
Ex or E	E	From, one of
Exhibeatur	Exhib.	Let it be exhibited
Ex modo prescripto	E. m. p.	After the manner prescribed, as directed
Extende	Ext.	Spread
Extende super alutam mollem	Ex. sup. alut. moll.	Spread thou upon soft leather
Fac, Fiat, Fiant	F., Ft.	Make, let it be made, let them be made
Fac pilulas duodecim	F. pil. xii	Make 12 pills
Farina	. . . . . .	Flour
Fasciculus	. . . . . .	A bundle which can be carried under the arm
Febre durante	Feb. dur.	During the fever
Febris	. . . . . .	Fever
Femoribus internis	Fem. intern.	To the inner parts of the thighs
Fervens	Ferv.	Boiling
Fiant chartulæ xii	Ft. chart. xii	Make 12 powders
Fiant pilulæ xii	Ft. pil. xii	Make 12 pills
Fiant pulveres xii	Ft. pulv. xii	Make 12 powders
Fiant suppositoria iv	Ft. suppos. iv	Make 4 suppositories
Fiat cataplasma	Ft. cataplasm.	Make a poultice
Fiat ceratum	Ft. cerat.	Make a cerate
Fiat collyrium	Ft. collyr.	Make an eye wash
Fiat confectio	Ft. confec.	Make a confection
Fiat electuarium	Ft. elect.	Make an electuary
Fiat emplastrum 6 × 4	Ft. emp. 6 × 4	Make a plaster 6 by 4 inches
Fiat emplastrum epispasticum	Ft. emp. epispast.	Make a blister
Fiat emplastrum vesicatorium	Ft. emp. vesicat.	Make a blister
Fiat emulsio	Ft. emuls.	Make an emulsion
Fiat enema	Ft. enema.	Make an injection (for rectum)
Fiat gargarisma	Ft. garg.	Make a gargle
Fiat haustus	Ft. haust.	Make a draught
Fiat infusum	Ft. infus.	Make an infusion
Fiat injectio	Ft. injec.	Make an injection (for urethra)
Fiat lege artis	F. L. A.	Let it be made by the rules of art
Fiat linimentum	Ft. linim.	Make a liniment
Fiat massa	Ft. massa	Make a mass

Word or Phrase	Contraction	Meaning
Fiat massa et divide in pilulas xii	Ft. mas. div. in pil. xii	Make 12 pills
Fiat massa in pilulas xii dividenda	Ft. mas. div. in pil. xii	Make 12 pills
Fiat massa in trochiscos xl dividenda	Ft. mas in troch. xl. div.	Make 40 lozenges
Fiat mistura	Ft. mist.	Make a mixture
Fiat pulvis	Ft. pulv.	Make a powder
Fiat pulvis et divide in chartulas xii	Ft. pulv. et. div. in char. xii	Make 12 powders
Fiat pulvis in chartulas xii dividenda	. . . . . .	Make 12 powders
Fiat secundum artis regulas	F. S. A. R.	Let it be made according to the rules of art
Fiat solutio	Ft. solut.	Make a solution
Fiat suppositorium	Ft. suppos.	Make a suppository
Fiat trochisci xxiv	Ft. troch. xxiv	Make 24 lozenges
Fiat unguentum	Ft. ung.	Make an ointment
Fiat venæsectio	. . . . . .	Bleed
Fictilis	. . . . . .	Earthen
Filtra	. . . . . .	Filter (thou)
Fistula armata	. . . . . .	A syringe fitted for use
Flavus	Flav.	Yellow
Folius	Fol.	A leaf
Frustillatim	Frust.	In little pieces
Fuerit	. . . . . .	Shall have been
Gargarisma	Garg.	A gargle
Gelatinâ quâvis	. . . . . .	In any kind of jelly
Gradatim	. . . . . .	By degrees, gradually
Grana sex pondere	. . . . . .	Six grains by weight
Granum, Grana	. . . . . .	Grain, grains
Gratus	. . . . . .	Pleasant
Grossus	. . . . . .	Large, coarse
Gutta	Gtt.	A drop
Guttæ	Gtt.	Drops
Guttatim	Guttat.	By drops
Guttis quibusdam	Gutt. quibusd.	With a few drops
Harum pilularum sumantur tres	Har. pil. sum iii.	Let three of these pills be taken
Haustus	Haust.	A draught
Haustus purgans noster	H. p. n.	A purging draught made according to a practitioner's own formula
Hebdomada	. . . . . .	A week
Herba	. . . . . .	An herb
Heri	. . . . . .	Yesterday
Hic, Hæc, Hoc	. . . . . .	This

Word or Phrase	Contraction	Meaning
Hirudo	. . . . . .	A leech
Hora	H.	An hour
Horâ decubitûs	H. D.	At the hour of going to bed
Horæ unius spatio	Hor. un. spatio	At the expiration of an hour
Horâ somni	H. S. or Hor. som.	Just before going to sleep, or on retiring to rest
Horâ undecimâ matutinâ	. . . . . .	At the eleventh hour of the morning
Horis intermediis	Hor. interm.	In the intermediate hours
Idem	. . . . . .	The same
Identidem	. . . . . .	Repeatedly
Idoneus	. . . . . .	Proper
Immitatur	. . . . . .	Introduce it into
Imprimis	. . . . . .	First
Incide, Incisus	Inc.	Cut (thou), being cut
Inde	. . . . . .	Therefrom
In dies	In d.	From day to day, daily
Infunde	Inf.	Pour in
Ingerendo capsulas	. . . . . .	Put in capsules
In impetu effervescentiæ	. . . . . .	In the height of effervescence
Injectio	. . . . . .	An injection
Injiciatur enema	. . . . . .	Let an injection or clyster be given
In lagena bene obturata	. . . . . .	In a well-stoppered bottle
In pulmento	. . . . . .	In gruel
Instar	. . . . . .	As big as
Inter	. . . . . .	Between
Internus	. . . . . .	Inner
Involve gelatina	. . . . . .	Coat with gelatin
Ita	. . . . . .	In such manner
Jam	. . . . . .	Now
Jentaculum	Jent.	Breakfast
Julepus, Julepum	Jul.	A julep
Jusculum	. . . . . .	A broth
Juxta	. . . . . .	Near to
Kali præparatum (potassæ carbonas)	Kal. ppt.	Prepared kali, or carbonate or bicarbonate of potash
Lac	. . . . . .	Milk
Lamella	. . . . . .	Leaf or scale
Lana	. . . . . .	Flannel
Largus	. . . . . .	Abundant, plentiful
Laridum	. . . . . .	Lard
Lateri dolenti	Lat. dol.	To the side that is painful
Laxus	. . . . . .	Loose, open
Lectus	. . . . . .	A bed
Leniter terendo	. . . . . .	By rubbing gently
Leviter	. . . . . .	Lightly
Linteum	. . . . . .	Lint
Magnus	Mag.	Large

Word or Phrase	Contraction	Meaning
Mane, Mane primo	. . . . . .	In the morning, very early in the morning
Manipulus	M. or Man.	A handful
Manus	. . . . . .	The hand
Massa, Massa pilularis	. . . . . .	A mass, a pill mass
Matula	. . . . . .	A vessel or pot
Matutinus	. . . . . .	In the morning
Medius	. . . . . .	Middle
Mensura	. . . . . .	By measure
Mica panis	Mic. pan.	Crumb of bread
Minimum	M. or Min.	A minim
Minutum	. . . . . .	A minute
Misce	M.	Mix
Mitte, Mittatur, Mittantur	. . . . . .	Send, let it be sent, let them be sent
Mitte sanguinem ad uncias duodecim saltem	. . . . . .	Take away blood to 12 ounces at least
Mitte talis	. . . . . .	Send of such or this
Modicus	. . . . . .	Middle sized
Modo præscripto	Mod. præsc.	In the manner prescribed
Mora	. . . . . .	Delay
More dictu, More solito	More dict., More sol.	In the manner directed, in the usual manner
Mortarium	. . . . . .	A mortar
Necnon	. . . . . .	Also
Ne tradas sine nummo	Ne tr. s. num.	Do not deliver it unless paid. (Used by apothecaries as a caution to the assistant when the presence of the patient prevents the master from giving a verbal direction)
Nisi	. . . . . .	Unless
Non	. . . . . .	Not
Nonrepetatur	Non. rep.	Do not repeat
Nox, noctis	. . . . . .	Night
Nucha	. . . . . .	The nape of the neck
Numerus	No.	Number
Nunc	. . . . . .	Now
Nux Moschata	. . . . . .	A nutmeg
Obduce	. . . . . .	Cover, conceal, or coat
Obtritus	. . . . . .	Crushed
Occlusus	. . . . . .	Enclosed
Octarius	O.	A pint
Octavus	. . . . . .	Eighth
Octo	. . . . . .	Eight
Oculus	. . . . . .	The eye
Oleum lini sine igne	. . . . . .	Cold drawn linseed oil
Oleum olivæ optimum	O. O. O.	Best olive oil
Ollicula	. . . . . .	A little pot

Word or Phrase	Contraction	Meaning
Omni horâ, Omni bihorio, Omni quadrante horæ	Omn. hor., Omn. bih., Omn. quadr. hor.	Every hour, every two hours, every quarter of an hour
Omni mane	. . . . . .	Every morning
Omni nocte	. . . . . .	Every night
Opus	. . . . . .	Need, occasion
Ovum	. . . . . .	An egg
Pabulum	. . . . . .	Food, nourishment
Panis	. . . . . .	Bread
Pannus	. . . . . .	A rag
Pars, partis	. . . . . .	A part
Partes æquales	P. æ.	Equal parts
Partitis vicibus	Part. vic.	In divided doses
Parvulus	. . . . . .	An infant
Coch. parvulum	Coch. parv.	A teaspoonful
Parvus	. . . . . .	Little
Pastillus, Pastillum	. . . . . .	A little ball of paste, to take like a lozenge, etc.
Pectus	. . . . . .	The breast
Pediluvium	. . . . . .	A foot bath
Per	. . . . . .	Through, by
Peractâ operatione emetici	. . . . . .	When the operation of the emetic is finished
Per deliquium	. . . . . .	By deliquescence
Pergo, pergere	. . . . . .	To go on with
Perinde	. . . . . .	In the same manner as before
Pes	. . . . . .	The foot
Phiala prius agitata	P. P. A.	The bottle having been first shaken
Pilula	. . . . . .	A pill
Pilus	. . . . . .	The hair
Pinguis	. . . . . .	Fat, grease
Placebo	. . . . . .	To please, satisfy
Plenus	. . . . . .	Filled
Poculum, Pocillum	Pocul., Pocill.	A cup, a little cup
Pondere	P.	By weight
Pondus civile	. . . . . .	Civil weight (avoirdupois weight)
Pondus medicinale	. . . . . .	Medicinal (apothecaries') weight
Pone aurem	. . . . . .	Behind the ear
Post cibo	. . . . . .	After eating
Post singulas sedes liquidas	. . . . . .	After every loose stool
Potus	. . . . . .	Drink
Prandium	Prand.	Dinner
Primo mane	. . . . . .	Very early in the morning
Primus	. . . . . .	The first
Pro	. . . . . .	For
Pro ratione ætatis	. . . . . .	According to the age of the patient

Word or Phrase	Contraction	Meaning
Pro re nata	P. r. n.	Occasionally
Proximo	. . . . . .	Nearest
Pruis	. . . . . .	Before, former
Pugillus	Pug.	A pinch, a grip between the thumb and first two fingers
Pulpa	. . . . . .	Pulp
Pulvis, Pulverizatus	Pulv.	A powder, powdered
Pyxis	. . . . . .	A pill box
Quam libet	. . . . . .	As much as you wish
Quantum libet, Quantum placet, Quantum vis, Quantum volueris	Q. l., Q. p., Q. v.	As much as you please
Quantum sufficiat, Quantum satis	Q. S.	As much as is sufficient
Quaque	Q. Q.	Each or every
Quaque horâ	. . . . . .	Each hour
Quartus	. . . . . .	Fourth
Quater	. . . . . .	Four times
Quatuor	. . . . . .	Four
Quibus	. . . . . .	From which
Qui libet	. . . . . .	Whatever you please
Quinque	. . . . . .	Five
Quintus	. . . . . .	The fifth
Quoque	Q. Q.	Also
Quorum	Quor.	Of which
Quotidie	. . . . . .	Daily
Quoties	. . . . . .	As often as
Rarus	. . . . . .	Loose, thin, rare
Ratio	. . . . . .	Proportion
Recens	Rec.	Fresh
Recipe	℞	Take
Redactus in pulverem, redigatur in pulverem	Red. in pulv., redig. in pulv.	Let it be reduced to powder
Regio umbicilli	. . . . . .	The umbilical region
Reliquus	. . . . . .	Remaining
Renovetur semel	. . . . . .	Renew once only
Repetatur, Repetantur	Rept.	Let it be repeated, let them be repeated
Res, rei	. . . . . .	Thing, substance, object, etc.
Residuus	. . . . . .	Remaining
Respondere	. . . . . .	To answer
Retinere	. . . . . .	To keep
Ruber	. . . . . .	Red, ruddy
Saccellatio	. . . . . .	A dry poultice
Saepis	. . . . . .	Often, frequently
Saltem	. . . . . .	At least
Scatula	Scat.	A box
Scilicet	. . . . . .	Namely
Scutum	. . . . . .	For protection

Word or Phrase	Contraction	Meaning
Secundum artem, Secundum naturam	S. A., S. N.	According to art, according to nature
Secundus	. . . . . .	Second
Sedes	. . . . . .	The alvine evacuation
Semel	. . . . . .	Once
Semidrachma	Semidr.	Half a drachm
Semihora	Semih.	Half an hour
Semis	Ss.	A half
Seorsum	. . . . . .	Apart, separate
Septem	. . . . . .	Seven
Septimana	. . . . . .	A week
Sericum oleatum	. . . . . .	Oiled silk
Sescuncia	. . . . . .	An ounce and a half
Sesquihora	. . . . . .	An hour and a half
Sex	. . . . . .	Six
Sextus	. . . . . .	Sixth
Si	. . . . . .	If
Siccus	. . . . . .	Dry, dried
Sic, Sic?	. . . . . .	So, is it so?
Signa	Sig.	Mark thou
Signetur nomine proprio	. . . . . .	Let it be written upon with the proper name (not a trade name)
Sile hujus	. . . . . .	Keep silent concerning this
Simul	. . . . . .	Together
Sine	. . . . . .	Without
Singulorum	Sing.	Of each
Si non valeat	Si n. val.	If it does not answer
Si opus sit	Si op. sit	If necessary
Sit	. . . . . .	Let it be
Si vires permittant	Si vir. perm.	If the strength will bear it
Solatium	. . . . . .	Soothing, assuaging
Solitus	. . . . . .	Accustomed, ordinary
Solus	. . . . . .	Alone
Solve	. . . . . .	Dissolve
Solvo, solvere, Solutus	. . . . . .	To dissolve, dissolved
Somnus	. . . . . .	Sleep
Sparadrapus	. . . . . .	A spread plaster
Spiritus vini rectificatus	. . . . . .	Rectified spirit of wine
Spiritus vini tenuis	. . . . . .	Proof spirit
Spiritus vinosus	. . . . . .	Ardent spirit of any strength
Spissus	. . . . . .	Dense, hard
Statim	Stat.	Immediately
Stet, Stent	St.	Let it stand, let them stand
Stillatim	. . . . . .	By drops, or in small quantities
Stilus	. . . . . .	Pencil, stick, or crayon
Stratumsuper stratum	S. S. S.	Layer upon layer
Subactus	. . . . . .	Subdued

Word or Phrase	Contraction	Meaning
Sub finem coctionis	. . . . . .	When the boiling is nearly finished
Subinde	. . . . . .	Frequently
Subtilis	. . . . . .	Fine, smooth, nice
Succus	. . . . . .	Juice, sap
Sumat talem	. . . . . .	Let the patient take one like this
Sume, Sumat, Sumatur, Sumantur, Sumendus	Sum.	Take (thou), let him take, let it be taken, let them be taken, to be taken
Summitates	. . . . . .	The summits or tops
Superbibendo haustum	. . . . . .	Drinking afterwards this draught
Supra	. . . . . .	Above
Tabella (dim. of tabula, a table)	Tabel.	A lozenge
Talis	. . . . . .	Such, like this
Tandem	. . . . . .	At last, finally
Tantum	. . . . . .	So much, so many
Tegmen or Tegumen	. . . . . .	A cover
Tempori dextro	. . . . . .	To the right temple
Tempus, temporis	. . . . . .	Time or temple
Tenuis	. . . . . .	Fine, thin
Ter	. . . . . .	Three times
Tere	Ter.	Rub
Ter in die, or Ter die	T. i. d., or t. d.	Three times a day
Tertius	. . . . . .	Third
Tres	. . . . . .	Three
Triduum	. . . . . .	Three days
Tritura	Trit.	Triturate
Tum	. . . . . .	Then, furthermore
Tussis	. . . . . .	A cough
Tuto	. . . . . .	Safely
Ubi	. . . . . .	Where, wherever, whenever
Ultimo (or Ultima) præscriptus	Ult. præsc.	The last ordered
Una	. . . . . .	Together
Uncia	. . . . . .	An ounce
Unctulus	. . . . . .	Besmeared, anointed
Unguilla	. . . . . .	An ointment box
Ustus	. . . . . .	Burned
Ut dictum	Ut Dict.	As directed
Utendum	Utend.	To be used
Uto, uti	. . . . . .	To make use of
Vas Vitreum	. . . . . .	A glass vessel
Vehiculum	. . . . . .	A vehicle
Vel	. . . . . .	Or
Venæsectio brachii	. . . . . .	Bleeding in the arm
Venenosus	. . . . . .	Poisonous, a poison
Verus	. . . . . .	True, genuine
Vesper, vesperis	Vesp.	The evening
Vices	. . . . . .	Turns
Vis, viris	. . . . . .	Strength
Vitellus	. . . . . .	Yolk
Vitello ovi solutus	. . . . . .	Dissolved in the yolk of an egg
Vitreum vitrum	. . . . . .	Glass
Vomitione urgente	Vom. urg.	The vomiting being troublesome

AUTOGRAPH AND QUESTIONABLE PRESCRIPTIONS

In the following pages will be found facsimiles of prescriptions taken from the author's collection. One of the most important duties of the pharmacist is the unravelling of prescriptions, and upon his cleverness in accurately divining the intention of the physician will often depend his reputation for skill and ability. It may be found that as one's experience in the art of interpreting increases, there will be ample justification and respect for the philologist who dignified the art of writing prescriptions by such a massive word as "Pharmacocatagraphologia." It is not to be supposed that all of the prescriptions which follow are of a character which would prove stumbling blocks to those having had experience in this difficult art; indeed, the author has the highest regard for the rare sagacity possessed by the American pharmacist, who has an international reputation for acuteness, and his only apology for presenting them is that he has some hope of aiding the younger members by some useful practice.

It should be noted that the facsimile prescriptions in the following pages, while faithful reproductions, are really clearer and are usually easier to read than the originals, because it has been found impossible to reproduce blurred lead pencil marks, greasy spots, finger marks, and the crumpled paper, which are such important factors in obscuring the legibility of every day prescriptions.

The succeeding illustrations are all that there is space for. They show the importance of writing prescriptions upon regularly printed or engraved blanks, on which the name of the physician is clearly shown, with his office hours and address, in order that the pharmacist in case of necessity may confer with him speedily and have all doubts removed about the interpretation of the prescription.

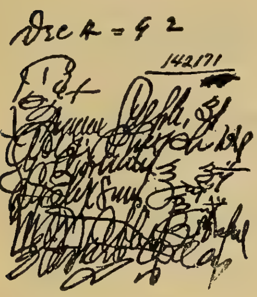
Omissions and Errors.—If an *obvious* error or omission is detected by the pharmacist, or an unusually large or poisonous dose has been prescribed, it is generally easy to gain the requisite delay, upon the plea that the prescription will require considerable time to compound, or for some other reason which will not excite the suspicions of the patient and in the meantime the physician may be consulted and the difficulty removed. Good judgment is necessary at all times, and where delay is entirely inadmissible there is nothing left for the pharmacist to do but to assume the responsibility of making the dose safe, or of supplying the omission according to his best judgment. In this case a written explanation should be sent immediately to the physician.

In the case of omissions or errors on the part of the pharmacist, so much judgment is needed which must depend upon the circumstances surrounding each case, that it would be unsafe to offer any suggestions. Generally the physician must be appealed to, and upon his skill and tact reliance must be placed. In such cases it is not often that he is found unwilling to exercise his good offices. One instance is on record showing rare tact on the part of an apothecary. It occurred before the practice of checking prescriptions became common. After renewing a mixture, he realized, just as he was in the act of handing the bottle to the nervous and suspicious old gentleman for whom it was intended, that he had omitted one of the principal ingredients. To hand it to him and permit his departure would have been professional suicide; to hesitate and take it back after the patient had watched the process of compounding, and had seen the bottle labelled and wrapped, would have excited unpleasant suspicions and have been equally disastrous. At once grasping the situation, he dropped the bottle upon the counter, allowing it to break to pieces, while in the act of handing it to the patient; then, with an apology for the accident, he quickly proceeded to compound the mixture over again, this time with every ingredient in it. He fully believed that any proper sacrifice should be cheerfully made to avoid loss of confidence.

Facsimile Prescriptions, with Notes.—In Fig. 491 will be found a reproduction of a prescription in the author's collection which illustrates what appears to be an attempt to confuse one who is not familiar with the writer's style. It is a mass of "jumbled" characters. Patience is necessary to decipher it, but it can be done by any pharmacist if time is taken to do it. Quinine sulphate, one drachm; acid. phosph. dil., two drachms; syr. aurantii, three ounces. He then intended to direct another syrup, but changed his mind and crossed out the "sy" and wrote elix. simp., three ounces. The directions are a tablespoonful three times a day.

Fig. 492 is a good representation of a class of prescriptions far too common in every day practice. If taken by a patient to a pharmacy where the habit and handwriting of the physician are not known it would prove a veritable puzzle. The first thought of the compounder will naturally be solution of magnesia; then the absence of directions will cause him to stop and consider. He may then run over in his mind the numerous solutions of magnesia with which he is familiar and possibly select one of the most harmless; then, choosing the best course, he asks the patient, in a matter-of-fact way, whether the doctor left any directions how the medicine was to be used. "Oh, yes, with a syringe." More puzzled now than ever, but not showing to the patient the slightest embarrassment, he suddenly catches the idea that Magendie's solution of morphine is to be used hypodermically. A few more skilful questions remove all doubt, and the patient hastens away convinced that the apothecary is careful, and never suspects that faulty abbreviation and a worse fault in writing the directions on the part of the physician have given the pharmacist one more reason to lament the doctor's serious want of care.

FIG. 491



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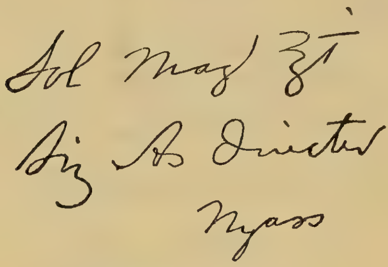
"Jumbled" prescription

FIG. 492



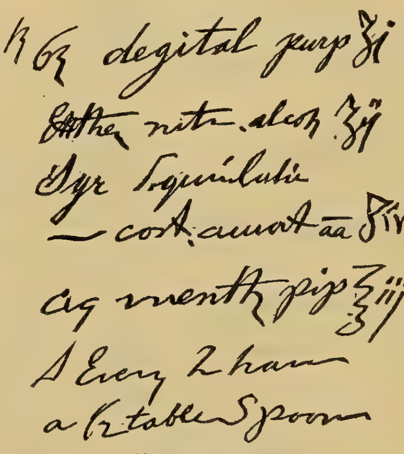
Sol Mag ℥i

Sig As Directed

Questionable prescription

The writer displays a lack of education by prescription 493, although there are no particular difficulties in compounding it. "Tr. degital purp" would be easily rendered by an experienced compounder tincture of digitalis. "Eather nitr. alcoh" would become spirit of nitrous ether. The next ingredient would be apt to puzzle the uninitiated, but any one familiar with German prescriptions would have no difficulty in selecting syrup of licorice as the article wanted, "Syr. Liquiritiæ" being the common term for it. The bad habit of using a dash to signify "the same," in place of a ditto mark, is not thoroughly established in this country, although there would be no great difficulty in guessing at the prescriber's meaning. The use of either ditto marks or dashes in prescription writing is a practice more honored in the breach than in the observance. The unusual order in which the quantity in the "Signa" appears betrays the nationality of the writer,—"Every 2 hours a ½ table spoon,"—although it would be easily understood to mean, Take a dessertspoonful every two hours.

FIG. 493



R Tr degital purp ʒi

Eather nitr. alcoh ʒii

Syr Liquiritiæ

— comp. aromat aa ℥iv

aq menth pip ℥iij ʒi

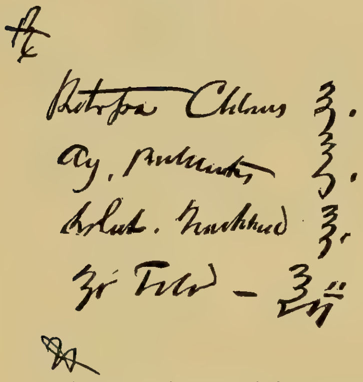
S Every 2 hours

a ½ table Spoon

Faulty prescription

Prescription 494 has proved a puzzle to many expert pharmacists. The bad habit of running the quantities into one another, the equally bad taste shown in using both English and Latin in the same prescription, and the exhibition of gross carelessness about the whole composition, make it a unique specimen. The original in the author's possession was written with a very soft lead pencil, and is considerably blurred. One drachm of potassium chlorate is to be dissolved in one ounce of boiling water, one ounce of solution of morphine, and two ounces of syrup of tolu. The dots which should be over the numerals representing 1's have

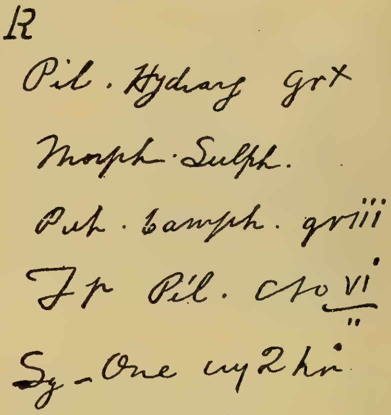
FIG. 494



℞
Potass Chloras ʒi.
Aq. bullient ℥i.
Solut. Morphine ℥i.
Syr Tolu – ℥ii

Carelessly written prescription

FIG. 495



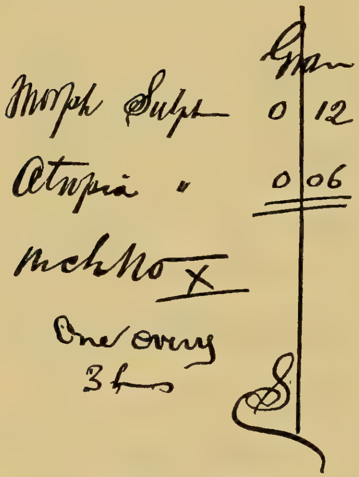
℞
Pil. Hydrarg gr x
Morph. Sulph.
Pulv. Camph. gr iii
Ft Pil. No VI
Sig. One ev 2 hrs

Faulty prescription

so strayed from their legitimate use as to have lost their identity entirely, and the third line is almost unrecognizable. One would suppose that its dangerous character would have saved it from such a fate.

Prescription 495 illustrates a common fault,—an omitted quantity. It has evidently been written for a patient suffering some pain, and has been designed for immediate use. Of course such a prescription should be instantly returned to the prescriber, the pharmacist gaining time by stating to the patient that it will take

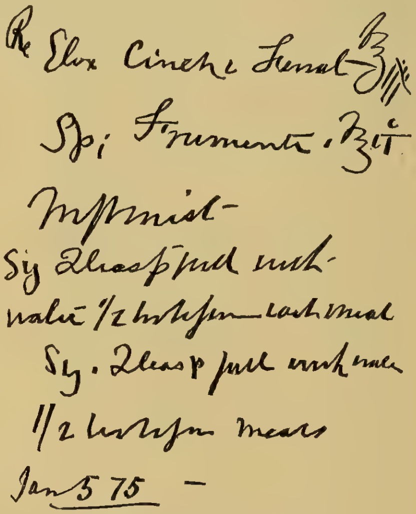
FIG. 496



Gram
Morph Sulph 0|12
Atropia " 0|06
mch No X
One every 3 hrs

Dangerous prescription

FIG. 497



℞ Elix Cinchon Ferrat ℥iii
Spi Frumenti ℥ii
M ft mist
Sig 2 teasp full with water 1/2 hr before each meal
Sig. 2 teasp full with water 1/2 hr before meals
Jan 5 75 –

Double direction prescription

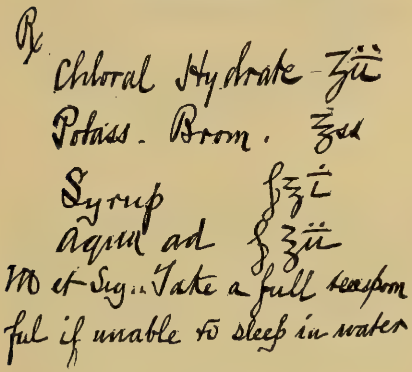
some time to compound it. If, however, there is great urgency, the physician not being accessible, and the pharmacist is prepared to assume the risks which such a course entails, one grain of morphine sulphate may be used if the patient is an adult and able to bear it, as it is strongly probable that the intention of the prescriber was to give one-sixth of a grain as a dose. This course is not recommended, however, as one to be followed by the pharmacist, except in rare emergencies, and the physician should be notified at once of the facts.

Fig. 496 is an exact reproduction of a prescription presented in the ordinary course of business. It was written by a young physician who had become enamoured of European methods, but had not sufficiently mastered the intricacies of the metric system to be sure of his doses. A dose of six centigrammes (about nine-tenths of a grain) of atropine sulphate was ninety times larger than he intended to give to the patient. In this case the prescription was held until amended, and the proverbial caution of the pharmacist saved the patient's life and probably the physician's reputation.

Prescription 497 is a facsimile of one written by a celebrated physician of Philadelphia. In all probability no greater difficulty was experienced in compounding the prescription than was found by the patient in taking it. It is rather unusual to duplicate the signa.

Prescription 498 would probably offer some difficulty in compounding on account of the deficiency of water, particularly in cold weather, potassium bromide being much more soluble in warm than in cold water. But the chief interest in this prescription centres in the directions to the patient, who, if so unfortunate as to be "unable to sleep in water," is required to take a "full" teaspoonful.

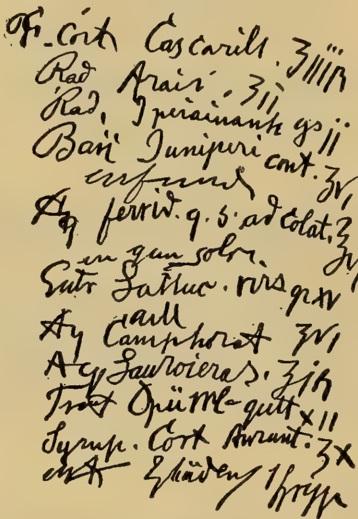
FIG. 498



℞ Chloral Hydrate ʒii
Potass. Brom. ʒss
Syrup f℥i
Aqua ad f℥ii
M et Sig.: Take a full teaspoonful if unable to sleep in water

Prescription with ambiguous signa

FIG. 499



℞ Cort Cascarill ʒiiiß
Rad Asari ʒii
Rad. Ipecacuanh grs ii
Bacc Juniperi cont. ʒvi
infund
Aq fervid. q.s. ad colat. ℥vi
in qua solv.
Extr Lactuc. viros gr xv
Aq Camphorat ʒvi
Aq Laurocerasi ʒiß
Tinct Opii smpl- gutt xii
Syrup. Cort Aurant. ʒx
MDS 3stündl 1 Löffel

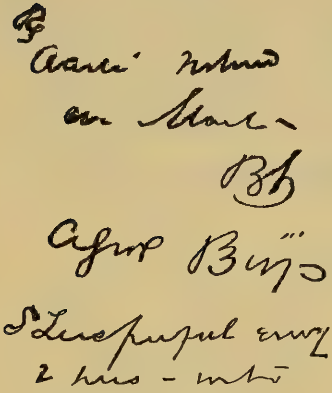
Involved prescription

In prescription 499, which was written by a German physician of the old school, we have an illustration of a peculiarly involved and cramped style; the difficulty in deciphering the original being greatly enhanced by the doctor's selection of a narrow, soiled piece of paper and a soft black lead pencil as the means of communicating his ideas of the patient's needs. The facsimile gives the style and the construction of the letters correctly, but fails to reproduce the imperfections of the lead pencil and coarse paper. Three and a half drachms of cascarilla bark, two drachms of asarum root, two grains of ipecac root, six drachms of bruised juniper berries, are to be infused with sufficient hot water to make the strained infusion measure six ounces, in which are to be dissolved fifteen grains of extract of lactucarium; it is then mixed with six drachms of camphor water, one and a half drachms of cherry laurel water, twelve drops of simple tincture of opium, and ten drachms of syrup of orange peel. A tablespoonful every three hours.

The prescription shown in Fig. 500 is a type of a style familiar to all who have occasion to read prescriptions. No attention whatever has been paid to reserving a line for each ingredient, and faulty abbreviation and careless writing have made a prescription not easy to decipher with any degree of certainty. If physicians would endeavor to use the official names for the preparations they prescribe, much labor would be saved and the liability to err would be greatly lessened. Half a fluidrachm of nitric and muriatic acid with three and a half fluidounces of water is the translation, and it is known in this case that the official nitrohydrochloric acid was wanted.

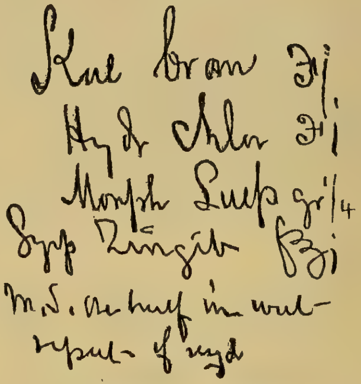
Fig. 501 affords another illustration of want of care in writing a prescription. Some of the letters show an ability on the part of the writer to form letters properly, which would indicate that he could write a legible prescription if he wished to; but the illegibility increases as the end of the prescription is approached, and hurry is plainly indicated. It happened that the medicine was intended for a poor dispensary patient; but one might suppose that poverty and sickness are heavy enough burdens to carry without having the additional and unnecessary one of the risk of losing life. One scruple of potassium bromide, one scruple of hydrated chloral (not chloride of mercury, calomel, or corrosive sublimate), one-quarter of a grain of morphine sulphate, are dissolved in one fluidounce of syrup of ginger. One-half is taken in water. *Repeated if required.*

Fig. 500



Badly written prescription

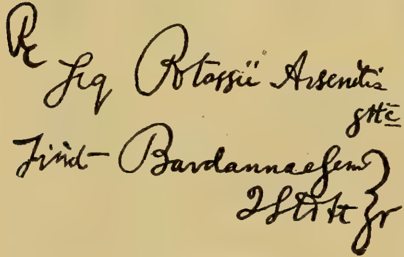
Fig. 501


Kal brom ℈j
Hyd Chlor ℈j
Morph Sulp gr 1/4
Syp Zingib ℥j

Carelessly written prescription

There is no lack of legibility in prescription 502. It is presented as showing a custom which some physicians practise,—*i.e.*, the employment of an unusual name. The object of using an out-of-the-way name may be a laudable one, although the physician is usually given the credit of trying to cover up some secret arrangement with an initiated and favored pharmacist. In this case the word "bardane" appears in the United States Dispensatory, and no intelligent pharmacist would have any difficulty in understanding that tincture of burdock seed was wanted. This being unofficial, it would be desirable to know from the physician what strength of tincture might be preferred.

Fig. 502

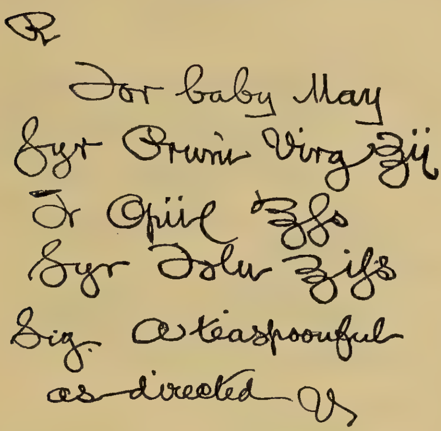

℞ Liq Potassii Arsenitis
gtt c
Tinct Bardannae sem

Odd prescription

At first glance it would seem that prescription 503 is ordinarily well written and free from fault. When the cautious dispenser looks it over carefully, however, he will observe that half a fluidounce of tincture of opium in a four ounce mixture, with a teaspoonful dose, would be a large quantity for "Baby May," and in all probabilitiy would permanently end her pain. A thorough examination indicates an abortive attempt at forming the letter "c" after the "opii," and if the ingredient is rendered "camphorated tincture of opium," a popular cough mixture is revealed, which is really what was intended by the prescriber.

Fig. 504 illustrates the effects of the loose methods that dispensary physicians are apt to acquire through the great haste usually practised in "getting through a clinic on time." Abbreviations, mixed Latin and English, and general lack of finish characterize the style. Five drachms and one scruple of potassium bromide and four scruples of hydrated chloral are to be dissolved in one fluidounce each of peppermint water and syrup; the quantity of bromide is excessive, and if the peppermint water is of full strength, a cloudy mixture results, due to throwing the volatile oil dissolved in the peppermint water out of solution. "A teaspoonful at bedtime in wineglass of water" should surely give the needed rest to the patient.

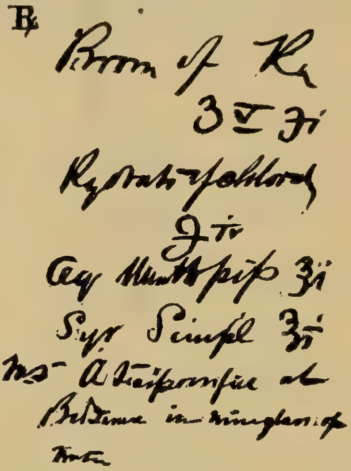
Fig. 503



℞
For baby May
Syr Pruni Virg ℥ij
Tr Opii ʒss
Syr Tolu ℥iss
Sig. A teaspoonful as directed

Faulty prescription

Fig. 504

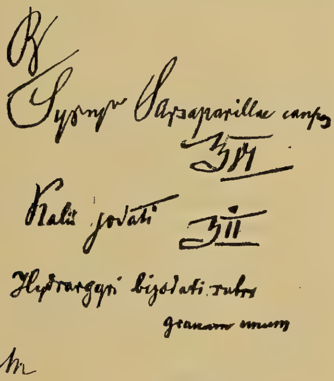


℞ Brom of K
ʒv ℈i
Hydrate of chloral
℈iv
Aq Menth pip ℥i
Syr Simpl ℥i
Ms. A teaspoonful at Bedtime in wineglass of water

Odd prescription

The prescription shown in Fig. 505 was written by a well educated German physician, and is presented as showing unusual care in designating the quantity of the dangerous ingredient. It certainly is rare to see upon American prescription files prescriptions in which the quantity of any ingredient is spelled out in full, either in Latin or in English; indeed, the whole prescription gives evidence of careful thought. One grain of red mercuric iodide and two drachms of potassium iodide are to be dissolved in six ounces of compound syrup of sarsaparilla.

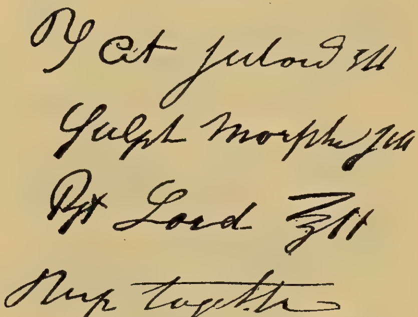
Fig. 505



℞
Syrupi Sarsaparillae comp.
℥VI
Kalii jodati ʒII
Hydrargyri bijodati rubri
granum unum
M.

Careful prescription

Fig. 506

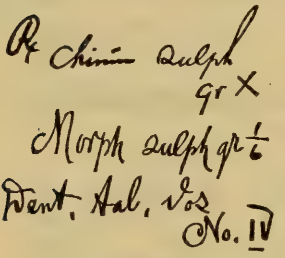


Badly written prescription

Fig. 506 shows a style now fortunately extinct in Philadelphia,—the worthy author having been "gathered to his fathers." He was a physician of excellent character, large practice, and unusual sagacity, but, alas! of execrable memory in prescription writing. Several of his prescriptions will be shown in this series, but the one now under consideration exhibits "one of his best." Two drachms of Goulard's extract, three grains of morphine sulphate, and two ounces of prepared lard (not lord) are to be rubbed together.

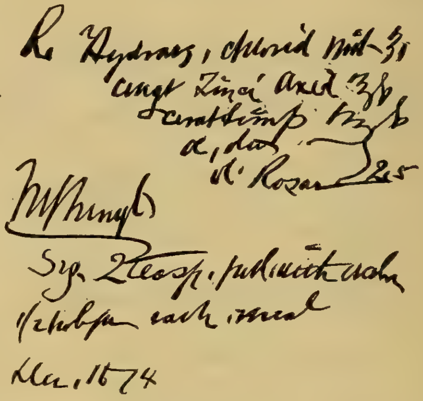
Fig. 507 is presented mainly with the view of illustrating a German custom which has not been adopted in this country to any extent by American physicians. Such prescriptions are common, however, in large cities. It will be noticed that the quantities are those for one dose. The abbreviated subscription is in full, "Dentur tales doses No. IV,"—let four such doses be given. The absence of any further direction to the apothecary might raise the question, Are powders or pills intended? But as the ingredients themselves are in the form of crystalline powders, and as pills are not specified, it would be proper to dispense four powders.

FIG. 507



German prescription

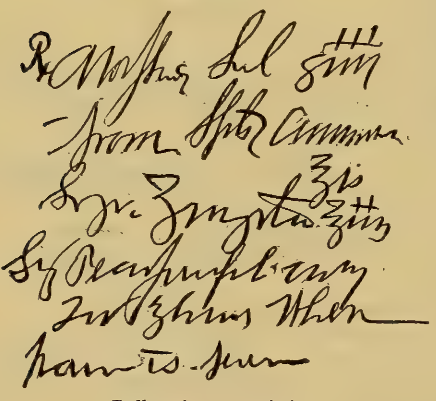
FIG. 508



Erroneous signa

Prescription 508 is a facsimile of one penned by a noted Philadelphia physician. Although not written in the clearest style, still it is legible, and no one would hesitate about preparing the ointment by taking one drachm of calomel, half an ounce of ointment of zinc oxide, half an ounce of simple cerate, and sufficient olive oil and oil of rose to make a smooth and sweet smelling ointment; but just here the apothecary will halt,—for, notwithstanding the attractiveness of the "unguent" and the delicious savor exhaled by it, it would not be judicious to label the box as the doctor has directed: "Two teaspoonfuls with water half an hour before each meal." It is clearly a case of "lapsus calami," and no harm would ensue if the apothecary were to shelter himself behind that convenient barrier provided for all such cases and simply write on the label, "Use as directed,"—for it is hardly likely that the doctor made the same error when giving the patient verbal directions that he has done in writing the prescription. In handing the ointment to the patient, any undignified tendency that the dispenser may have to relieve his feelings must be rigidly suppressed.

FIG. 509

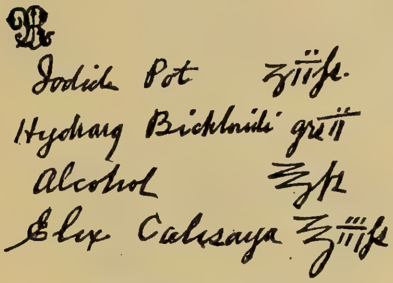


Badly written prescription

Prescription 509 exhibits ignorance of the laws of chemical incompatibility, coupled with a careless style of writing; yet abundant evidence of ability to write better is furnished in the formation of many of the letters. Three grains of morphine sulphate are to be dissolved in half an ounce of aromatic spirit of ammonia and two and a half ounces of syrup of ginger. The directions are, "a teaspoonful every two or three hours when pain is severe." The incompatibility belongs to the class illustrated in Chapter LXV, and is due to the fact that alkalies precipitate alkaloids from alkaloidal salts. The danger here would be apt to arise from the alkaloid morphine precipitating out and collecting in the bottom of the bottle, and the liability of the patient swallowing a poisonous quantity if the last dose be taken.

Fig. 510 shows a mixed style. The writing is legible, but "Iodide Pot," an abbreviation of the English name, and "Hydrarg Bichloridi," a partial abbreviation of the Latin name, with the lack of knowledge of correct terminology or abbreviation shown in writing out the other ingredients, quite prepare one for the writer ignoring the fact that the mercuric potassium iodide formed by dissolving corrosive sublimate in solution of potassium iodide will be apt to precipitate the cinchona alkaloids in the elixir of calisaya, for it is now the most useful and the most delicate reagent for alkaloids that has ever been discovered. One thing may, however, prevent this danger,—*i.e.*, the use of one of the very agreeable but worthless elixirs of calisaya that contains no alkaloids.

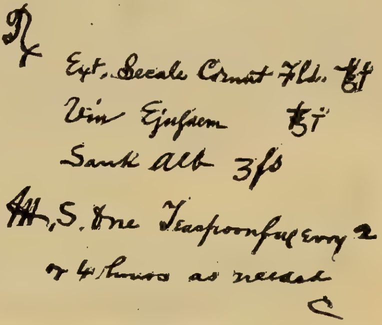
FIG. 510



℞
Iodide Pot ℥iiss.
Hydrarg Bichloridi grii
Alcohol ℥ss
Elix Calisaya ℥iiss

Incompatible prescription

FIG. 511

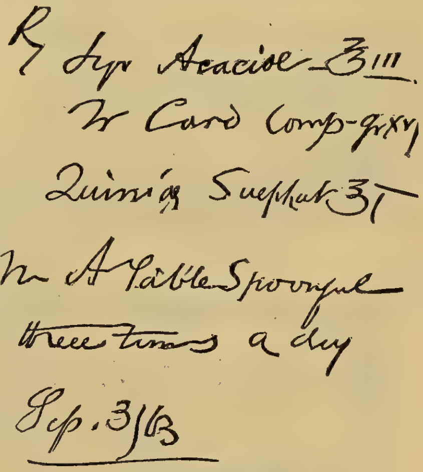


℞
Ext. Secale Cornut Fld. ℥i
Vin Ejusdem ℥i
Sach alb ʒss
M. S. One Teaspoonful every 2 or 4 hours as needed

Old fashioned prescription

In the case of prescription 511 no serious fault can be found with the manner of writing it; the interest in it simply lies in the fact that the druggist to whom it was presented had forgotten his Latin, the schoolmaster being needed. The second article proved a poser to him, and, after searching through the dispensatories and text books, and finding no substance in the materia medica bearing the title of "Ejusdem," he concluded that it was one of those "new-fangled proprietaries" that doctors are always writing for, and, with an air of injured dignity and superiority, he informed the patient that one of the ingredients he did not keep, and, returning the prescription, sent him away. The patient succeeded easily in having the prescription compounded by a neighboring pharmacist, and the story leaked out. The translation is, one fluidounce of fluidextract of ergot, one fluidounce of wine of the same (ergot), and half a drachm of white sugar.

FIG. 512



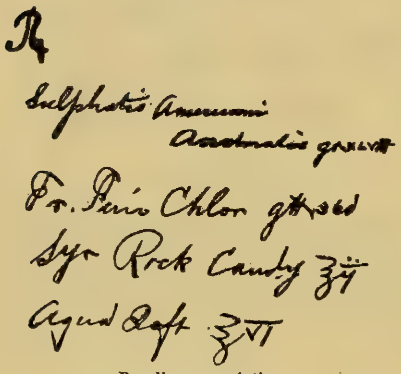
℞ Syr Acaciae ℥iii
Tr Card Comp gr xvi
Quinia Sulphat ʒi
M A Table Spoonful three times a day
Sep. 3/83

Erroneous prescription

Prescription 512 is a facsimile of one written by a well known physician. It is legible, and free from serious fault, with one exception,—the quantities have been inadvertently transposed. Sixteen grains of compound tincture of cardamom and one ounce of quinine sulphate are so far away from reasonable expectations that there should be no difficulty in "diagnosing this case" and deciding it to be one of transposition of quantities. It would be fortunate, indeed, if all instances of transposition were as glaring as this. It is a fault that often goes undetected, and its frequency arises from the habit which many good physicians have of deciding upon the ingredients that they wish to give their patient and filling in the quantities afterwards, not in consecutive order. An interruption or slight "lapsus" will be very apt to cause transposition.

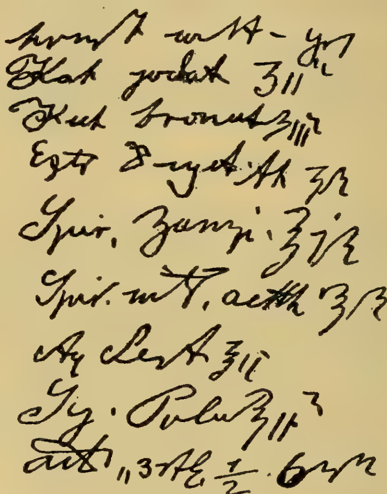
In prescription 513 an illustration is given of the use of a specially coined term to designate a well known substance, the intention being to calm the fears of a patient who has a perhaps unreasonable prejudice against a remedy which the physician believes to be necessary to alleviate the malady. Circumstances arise in the practice of every physician when patients need a remedy which they will refuse to take if they are aware of it, and hence the alleged necessity for the use of an unusual term which they will not understand when written on the prescription. "Sulphatis Americani Australis," South American Sulphate, is, in plain English, sulphate of quinine. The stilted Latin by which the first ingredient is designated is in strong contrast with the plain English of the third ingredient,—"Syrup of Rock Candy." The last line may cause a little studying, but it is soon translated Aqua q. s. ft. ℥vi.

FIG. 513



Puzzling prescription

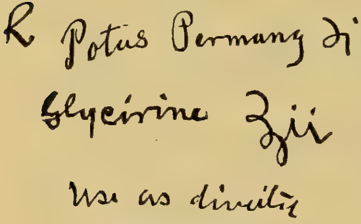
FIG. 514



German prescription

Fig. 514 is a facsimile of a prescription written by a German physician, which at first appears curiously involved, but really presents no great difficulty in deciphering when carefully scanned. One grain of morphine sulphate, two drachms of potassium iodide, three drachms of potassium bromide, half a drachm of ethereal extract of digitalis, one and a half ounces of spirit of juniper, half an ounce of spirit of nitrous ether, two ounces of distilled water, and two ounces of syrup of tolu, are the ingredients; while the signa, or the directions to the patient, are,—every three hours half a tablespoonful.

FIG. 515



R Potas Permang ʒi

Glycirine ℥ii

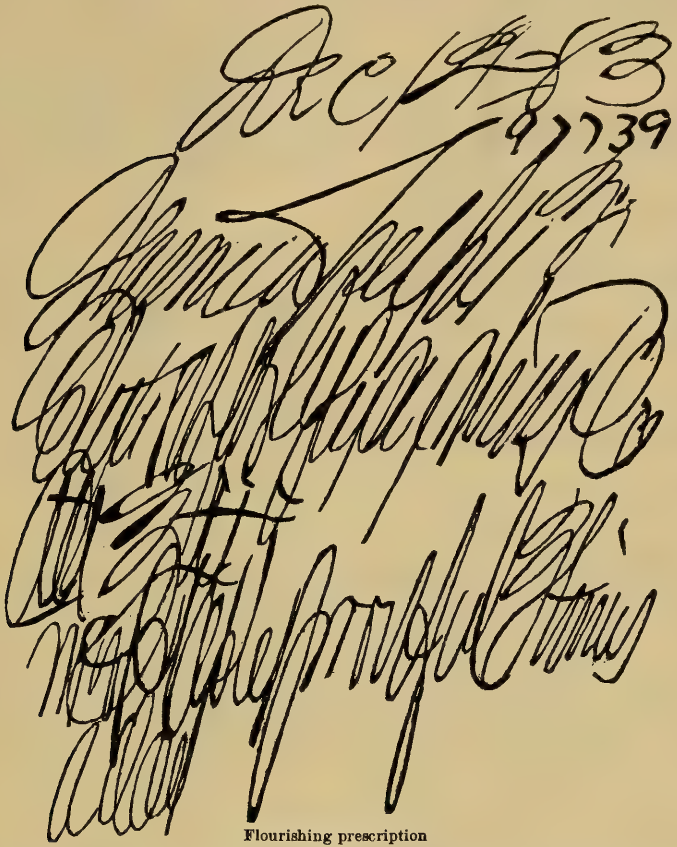
Use as directed

Explosive prescription

Prescriptions like that shown in Fig. 515 should be declined when presented, potassium permanganate exploding violently when mixed with glycerin and other bodies containing organic matter. This fact, and the additional one that glycerin does not have two i's, were doubtless overlooked by the writer of the prescription.

Prescription 516 has defied the efforts of all experts in calligraphy up to the present time. The author has shown the original and the facsimile to more than one hundred skilled pharmacists without receiving a correct solution from one of them. It was written by a Cleveland physician in the ordinary course of business, and was presented to the author by a brother pharmacist. The principal difficulty in deciphering it arises from the fact that two ingredients are unofficial and rather out of the way, and, in addition, their titles are run together and obscured almost beyond recognition. The full translation is as follows: "Dec. 14, 83. 97739. Quinia Sulph. ʒi; Elix. et Syr. Glycyrrhiza Co. āā ℥ii. M.—Tablespoonful 3 times a day." The author was informed by a pharmacist who was familiar with the doctor's method of writing prescriptions that the above specimen was not unusually obscure.

Fig. 516

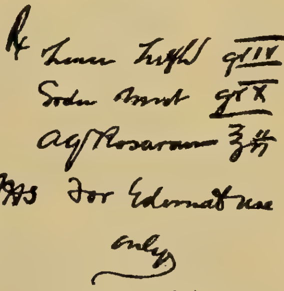


97739

Flourishing prescription

Fig. 517 is a facsimile of a prescription for an eye wash. The original was written with a hard lead pencil upon a rough bit of paper. Any one familiar with the doctor's style would have little difficulty in solving the obscurity by dissolving four grains of zinc sulphate and ten grains of sodium borate in two ounces of rose water. Incidentally, it may be remarked that precipitation frequently occurs in prescriptions of this character, due to precipitation of hydrated zinc oxide by the alkali in the sodium borate. It is better to filter

Fig. 517



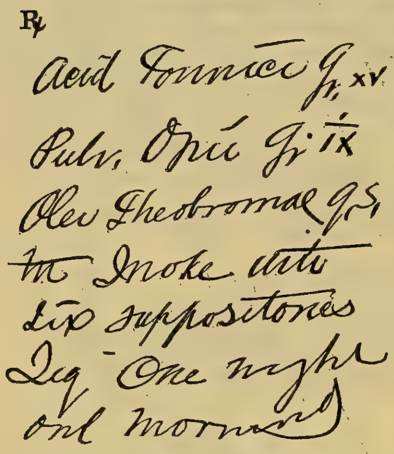
℞ Zinci Sulph gr iv
Sodii Borat gr x
aq Rosarum ℥ ii
M S For External use
only

Obscure prescription

the mixture than to add a little sulphuric acid to clear the solution, because the slightest excess of the latter might prove irritating.

The habit of making one letter look exactly like some other letter is one of the worst faults that a writer can have, and it is usually only a question of time for a prescriber with such a habit to make a serious error. It will be observed that in the facsimile (Fig. 518) the fault is that the doctor's small "a's" are always "o's." He writes "Tonnici" for "Tannici." "Inoke" is intended for "make." The next word is not "mte," but "into." The words "six suppositories" are, fortunately, plain enough, and the directions, "One night and morning," present no difficulty to a good guesser. The writer is an intelligent and unusually able physician, and force and character are indicated by the general style of the writing, marred, however, by the one serious fault.

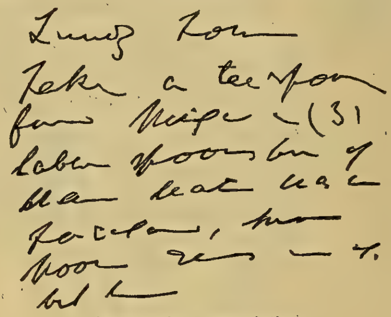
Fig. 518



℞
Acid Tonnici gr. xv
Pulv. Opii gr. ix
Olea Theobromæ q.s.
m. Inoke mte
six suppositories
Sig. One night and morning

Faulty prescription

Fig. 519



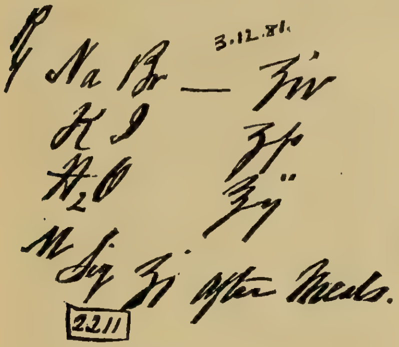
Badly written prescription

A study of the prescription illustrated in Fig. 519 will thoroughly justify the verdict that no extenuation can be fairly accorded to the writer. The facsimile cannot show the crumpled piece of manilla paper, nor reproduce the indistinct lead pencil marks, which are prominent characteristics of the original,—yet it was written by a noted physician "in a hurry." Who would guess that the first line is "Tinct. Iron"? and if any one should be so fortunate as to get so far, could he by any possibility translate the remainder?—"Take a teaspoonful mixed with (3) tablespoonsful of warm water sweetened, an hour before eating and at bedtime;" and yet this is the translation which was given by the friend who sent it to enrich the author's collection and affirmed to be correct. The difficulty about the acceptance of this guess centres around the word which is rendered "sweetened." The other words may or may not be correctly deciphered. Doubt and confusion reign supreme.

The use of chemical symbols in writing prescriptions is not a common custom, and although there can be no serious fault found with the prescription shown in facsimile in Fig. 520, there are objections to the custom notwithstanding some advantages. To begin with the latter, symbols are usually brief, distinctive, and capable of being written in unmistakable characters, but a physician who attempts to use them altogether must have a circumscribed list of remedies to prescribe from, for symbols have not been contrived for elixirs, syrups, or any galenical preparation; then, again, the symbols for alkaloids and some of the new antipyretics would be complicated and not so easily nor so clearly made out as the usual Latin abbreviations. In the example shown it is plain that the prescriber wants four drachms of sodium bromide and half a drachm of potassium iodide dissolved in two ounces of water.

Fig. 521 is a type of prescription which is very frequently seen in practice. It is impossible to expect any physician to retain in his memory the solubilities or exact physical properties of all the substances that he desires to prescribe. As pharmacy has advanced prescribers have grown into the habit of depending upon pharmacists to use their art in supplying the needed knowledge; and it follows, as a matter of course, that those who make a profession of handling the substances that enter into prescriptions every day should have this information ready for such an emergency. In this prescription two minims of oil of copaiba, two grains of magnesia, and one grain of powdered acacia are the ingredients for one pill, and the directions are that "thirty-six such pills are to be sent." A little more magnesia, a trace of water, and possibly a little powdered soap are needed to give the mass sufficient adhesivess and firmness.

FIG. 520



3.12.81

℞ Na Br — ℥iv

K I ʒss

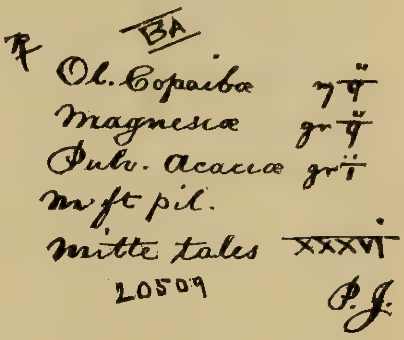
H_2O ℥ii

M Sig ℥i after meals.

2211

Prescription in symbols

FIG. 521



BA

℞ Ol. Copaibæ ♏ ii

Magnesiæ gr ii

Pulv. acaciæ gr i

M ft pil.

Mitte tales XXXVI

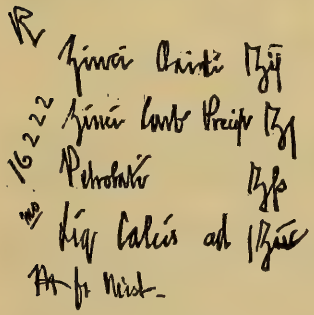
20509

P. J.

Pill prescription

A prescription like the one shown in Fig. 522 bears evidence of error on its face. The subscription directs a mixture to be made, and 75 percent. of the mixture is composed of solids. On the other hand, the dispenser is unable to guess whether the prescriber made an error in directing a mixture, or whether, unable to class the compound as an ointment, he has concluded to call it a mixture, and that the quantities of the ingredients are just what he intended to write. Probably most pharmacists would mix the powders thoroughly, rub in the petrolatum and lime water, and dispense the mixture in a box, labelling it, in the absence of directions, "Use as directed." If the physician could not be seen, this would be the course to pursue; but in the above case the quantity "fʒiv" after the "Liq. Calcis ad" happens to be a mistake. It should have been "f℥iv," and it was intended for an external application to an inflamed surface. There are, however, many instances on record where similar errors which were never corrected have occurred and the prescription dispensed as written, the patient subsequently returning to have the apparently absurd prescription renewed and ultimately praising the doctor for the speedy cure which had been effected.

FIG. 522



℞ Zinci Oxidi ʒij

Zinci Carb Precip ʒj

Petrolati ʒss

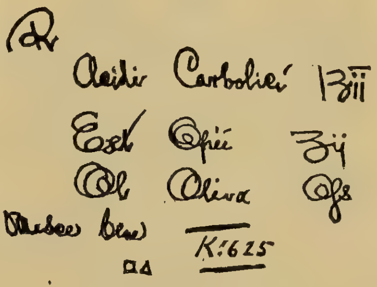
Liq Calcis ad fʒiv

Ft Mist.

16222

Erroneous prescription

FIG. 523



℞ Acidi Carbolici ʒii

Ext Opii ʒij

Ol Olivæ q.s.

Misce bene

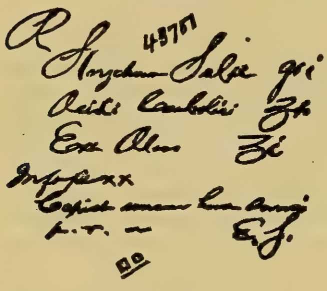
K:625

Incompatible prescription

In prescription 523 physical incompatibility is illustrated. Extract of opium is an aqueous extract, the greater bulk of it being insoluble in olive oil. The mixture is evidently intended for an external application, and all that is expected is a reasonably smooth mixture. The proper method of compounding this would be to rub the extract of opium with sufficient water to make a smooth paste. Now, having poured the oil into the bottle in which the mixture is to be dispensed, add the carbolic acid, shaking it well until solution is effected, then gradually add the thick aqueous mixture of extract of opium, shaking after each addition. Do not filter the mixture, but dispense with a shake label.

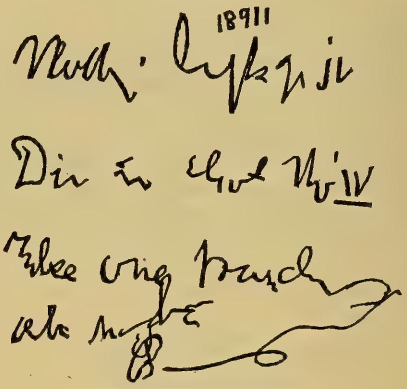
Prescriptions like the one shown in Fig. 524 are very common; too much liquid has been ordered. It is a difficult matter for prescribers to educate themselves in the matter of not exceeding practical limits in ordering liquids for pill masses; indeed, the absorptive power of the solid substances used in making pill masses varies so much that usually nothing short of an actual attempt to make the mass will prove the extent of the excess. In this case, in all probability, the prescriber regarded carbolic acid as a solid, and he did not know of its tendency to liquefy under warmth and manipulation and its liability to cause other solids to soften. The difficulty here is that if sufficient absorbent powder be used to take up the excess (powdered althea would be an excellent one to use here) the pills will be very large. A nice question arises just at this point: Has the pharmacist the right to double the number of pills and alter the doctor's directions so that the dose shall be two pills instead of one? There are certain occasions when this may be done, *but they should be rare indeed.* It is not creditable for a pharmacist to acquire a reputation for altering the directions of a physician. Every expedient known to the art should be exhausted before attempting the slightest change, and, if it must be, the intention of the prescriber should always be kept closely in view. In the above case, if the number of pills is doubled without the doctor's sanction or knowledge, the patient must be acquainted with the fact at the time, otherwise, he will suspect that the pharmacist has blundered and has made too many pills; and if the patient is informed about it when the pills are dispensed, unless great tact is used he will probably suspect that the doctor does not understand his business, and may state his opinion to him at his next visit, in which event the pharmacist will probably have a call from the doctor. The best practice is to notify the prescriber at once of the change and let him make the necessary explanation to the patient.

Fig. 524



Faulty prescription

Fig. 525

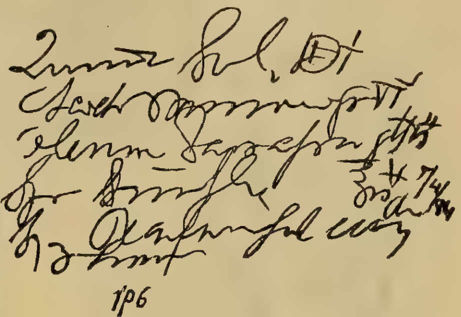


Intemperate prescription

Prescriptions like the one shown in facsimile 525 are fortunately rare. It was written and presented personally by a physician very early in the morning, soon after having parted with some friends with whom he had been spending the evening, the pharmacist having been rung up by the night bell to dispense it. The prescriber's mental condition is accurately indicated by the fluctuating irresolution of some of the written characters and by the poisonous dose of morphine. He endeavored to explain that the dose was intended for himself, and it is hardly necessary to say that it was not dispensed as written. The translation is: Four grains of morphine sulphate divided into four powders; take one powder at night. He really wanted one grain divided into four powders, and this was given to him. In cases of this kind a pharmacist could not be justly condemned for refusing to compound the prescription; and, indeed, it should be the rule always to decline to furnish morphine or other poisonous remedies to any intoxicated person. In this particular instance the physician had friends with him who made themselves responsible for his safety.

Prescription 526 is another illustration of a badly written prescription, and one which defies the laws of both chemical and physical incompatibility. One scruple of quinine sulphate, six grains of morphine acetate, two drops of oil of sassafras, and five and a half ounces of simple syrup are to be mixed, and a teaspoonful administered every three hours. The insertion of the curious character, which resembles a capital letter A reversed, is an illustration of a careless and reprehensible method of correcting an error. The quantity originally attached to the "Syr. Simple" was ℥ss. This would yield a poisonous quantity of morphine, the mixture being given in teaspoonful doses. The addition of ∀ over the "ss" was intended to make the dose of morphine a proper one; but it would in most cases fail signally to accomplish the intention of the prescriber, for it would not be so interpreted. When strong solutions of quinine sulphate and morphine acetate are brought together, decomposition results, with the production of the insoluble quinine acetate. In addition to this, the oil of sassafras would not dissolve entirely in the syrup, and it would consume a great deal of time to filter so thick a mixture. The only way out of such a combination of errors for the pharmacist, in the absence of the physician, is to paste a shake label on the bottle and dispense it.

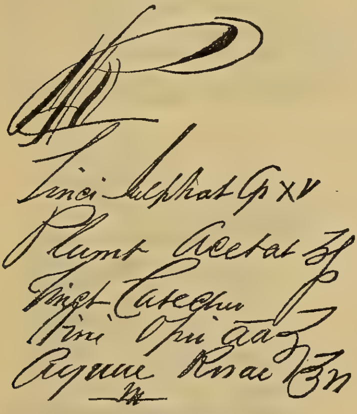
FIG. 526


1p6

Carelessly written prescription

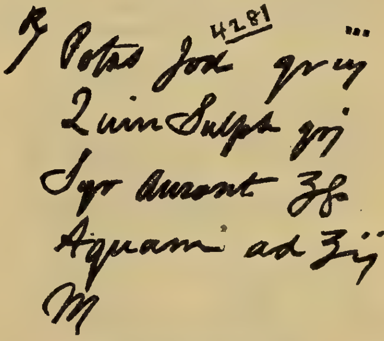
In prescription 527, which is reasonably well written, is afforded an example of intentional incompatibility. Fifteen grains of zinc sulphate, half a drachm of lead acetate, and one drachm each of tincture of catechu and wine of opium are to be mixed with six ounces of rose water. This mixture should not be filtered, of course. The unusually elaborate character for recipe at the top of the prescription might reasonably be accused of indicating a relapse to the habit of former ages, when prescriptions were decorated with mystic signs. These were supposed to possess supernatural powers. The patient who needed such a prescription as 527, however, probably required a special invocation.

FIG. 527


Zinci Sulphat Gr XV
Plumb Acetat ʒß
Tinct Catechu
Vini Opii aa ʒj
Aquae Rosae ℥vj

Careless prescription

FIG. 528

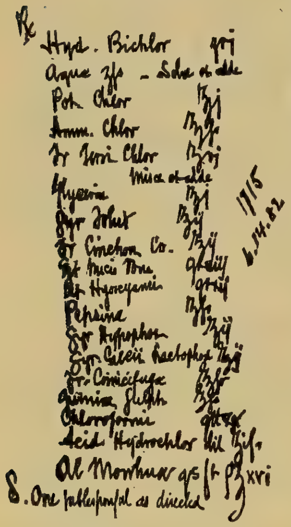

4281
℞ Potas Iod gr iij
Quin Sulph gr j
Syr Auront ʒß
Aquam ad ℥ij
M

Incompatible prescription

In 528, precipitation, due to decomposition between the potassium iodide and the quinine sulphate, will take place and quinine iodide will separate. The addition of mucilage as a retarding agent has been recommended in such cases, but it is very ineffective, and the best course is to depend upon a shake label pasted on the bottle, with verbal directions to the patient to call attention to the necessity for shaking the mixture before taking a dose. Iodides and bromides should never be given in combination with alkaloidal salts (see page 1678). There can be no difficulty in reading this prescription. The translation is: Three grains of potassium iodide, one grain of quinine sulphate, half a drachm of syrup of orange, with sufficient water to make two drachms.

Fig. 529 is a copy of a prescription which was written by a physician in Canada. Three similar prescriptions were sent to the author by a Canadian pharmacist to enrich his collection, and the one selected for this illustration is by no means the best or the worst. They were all written by the same physician. He believes in "polypharmacy" and the doctrine that "there can't help but be something in such a prescription which will do good." Such prescriptions are not worthy of analysis. The best way to compound this one is to mix all the solids, reduce them to as fine a powder as possible, dissolve them in the mixed liquids, leaving out the chloroform and cod liver oil; then with the aid of acacia make a mixture with the cod liver oil and chloroform. No attempt to prepare a clear solution of the solids need be made; any excess will be suspended in the emulsion of cod liver oil.

FIG. 529

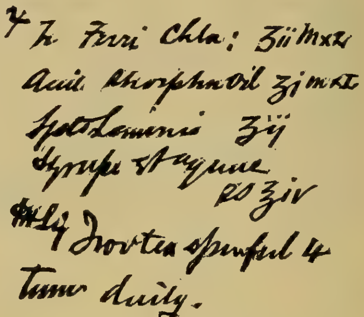


℞ Hyd. Bichlor gr. j
Aquae ℥ss – Solve et adde
Pot. Chlor ʒj
Amm. Chlor ʒiss
Tr. Ferri Chlor ʒij
Misce et adde
Glycerin ʒj
Syr. Tolut ʒij
Tr. Cinchon. Co. ʒij
Ext. Nucis Vom. gr. iij
Ext. Hyoscyami gr. iij
Pepsina ʒss
Syr. Hypophos ʒij
Syr. Calcii Lactophos ʒij
Tr. Cimicifuga ʒss
Quinine Sulph ʒss
Chloroformi gtt. xx
Acid Hydrochlor dil ʒiss
Ol. Morrhuae q.s. ft. ℥xvi
S. One tablespoonful as directed

1715
6.54.82

Polypharmacal prescription

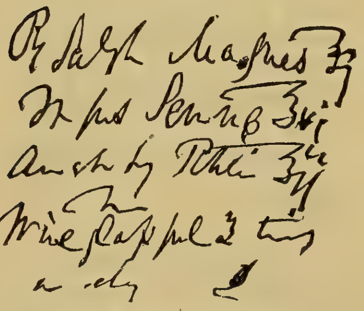
FIG. 530



℞ Tr. Ferri Chlor: ʒii ♏xx
Acid. Phosphoric dil ʒi ♏xl
Spts Lamini ʒij
Syrupe [illegible]
ad ℥iv
M. Sig. 1 Dessert spoonful 4
times daily.

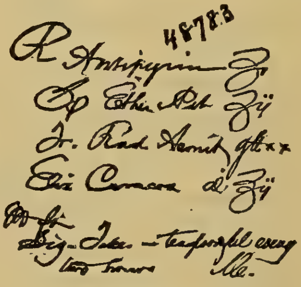
Obscure prescription

FIG. 531



Carelessly written prescription

FIG. 532



48783

℞ Antipyrin ʒj
Sp. Ether Nit. ℥ij
Tr. Rad. Aconit gtt. xx
Elix. Curacoa ad ℥iij
M. ft.
Sig. Take – teaspoonful every two hours

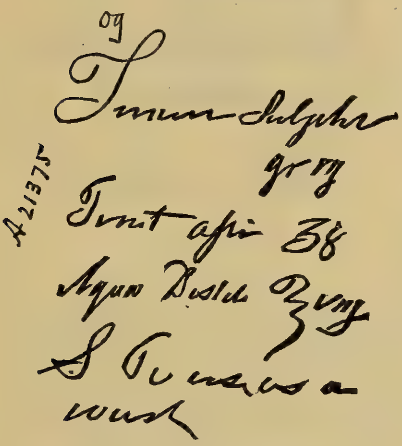
Modern prescription

Fig. 530 is a facsimile of a prescription which has been carefully considered by the prescriber; he has evidently bestowed the greatest attention upon the dose of the active ingredients, but there is considerable obscurity about the third ingredient.

An experienced compounder, however, would read the prescription without difficulty. Two drachms and forty minims of tincture of ferric chloride, one drachm and forty minims of diluted phosphoric acid, two drachms of spirit of lemon, and syrup and water to four ounces. "Two teaspoonfuls" four times daily. A precipitation may take place when the tincture of ferric chloride is mixed with the diluted phosphoric acid, due to the formation of insoluble ferric pyrophosphate, particularly if the diluted phosphoric acid which is used has been freshly made. This precipitate may be dissolved by adding a trace of potassium citrate or any alkaline citrate.

The facsimile shown in Fig. 531 is that of an old fashioned prescription, and a type of the sort now fortunately numbered with the past. Epsom salt, infusion of senna, and aromatic syrup of rhubarb form a trio which would be difficult to surpass in developing nausea; but the dose,—a "wineglassful three times a day" (presumably about meal times),—if retained, would be likely to prove an efficient cathartic. The second line might be translated, compound infusion of senna, but the letters which look something like "co" are evidently "æ," and the use of simple infusion of senna was common at the time when this prescriber studied medicine. The third line is somewhat obscure also, but the intention of the prescriber is so apparent and its artlessness is so sincere that the line may be easily guessed. One ounce of magnesium sulphate, six ounces of infusion of senna, and two ounces of aromatic syrup of rhubarb are to be compounded.

FIG. 533



03

Tinni Sulphr gr vij

Tinct api ʒj

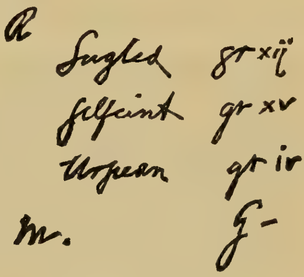
Aqua Distil ℥viij

S To use as a wash

42137

Badly written prescription

FIG. 534



℞

Sugled gr xii

Silfeint gr xv

Urpean gr iv

M. ʒ

Misleading prescription

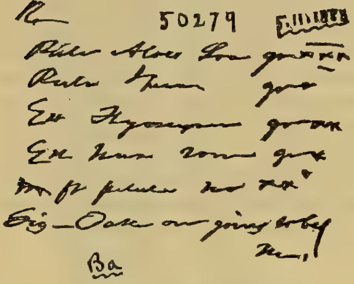
Fig. 532 is a prescription which offers a strong contrast to the preceding one. It represents modern therapeutics in more senses than one. An emerald green coloration is apt to be produced when antipyrine is brought in contact with nitrous compounds. This cannot be avoided. Investigation seems to indicate, however, that no dangerous poison is developed through this decomposition; yet it would be better to avoid prescribing antipyrine with spirit of nitrous ether until the action is clearly determined. The substitution of acetanilide or any other antipyretic for the one ordered, without the physician's knowledge or consent, as sometimes practised, is entirely without justification.

Prescription 533 shows illiteracy and general deficiency. Seven grains of zinc sulphate, one drachm of tincture of opium, and eight ounces of water are to be made into a lotion, and the direction is "To use as a wash." The letter "Z" is very far from being the ordinary form, and much more resembles the letter "T," while the other letters of this word are not recognizable as "inci;" "opi," in the second line, is more like "api," and, since preparations of celery and parsley, both "apiums," are now prescribed, there might be some danger of confusion if the construction of the letters were alone depended upon. The evident *intention of the prescriber* is a very important element, however, in guiding the pharmacist, who is expected to unravel the mysteries of compounding such prescriptions.

Prescription 534 must not be read with the Pharmacopœia as a guide; but it is best to have a layman read the prescription hastily, and then judge by the sounds how near such sounds resemble those of the names of familiar substances and which might be used in pronouncing "sugar of lead," "sulphate of zinc," "morphine.” The object of writing such a prescription is concealment; and it is far safer for the pharmacist to decline to become a party to a questionable procedure, particularly one which involves the sale of a poisonous dose of morphine unauthorized by a physician. The intention is to add water to the mixture and thus complete the lotion. The temptation to overcome difficulties or to increase the number on the prescription file and to meet all possible contingencies should not be allowed to warp the pharmacist's judgment. Improper prescriptions should be declined politely but unconditionally.

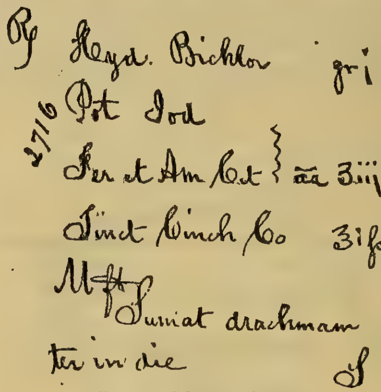
Prescription 535 has been hastily written, but it is reasonably clear. The quantity attached to the first ingredient is somewhat ambiguous. Should gr. xxx or gr. xxv be dispensed? The upper part of the last x has been imperfectly made, so that an inverted v is the result. It is impossible that such a character as an inverted v would be used intentionally. Hence the conclusion is reached that thirty grains are wanted. This, with five grains of powdered ipecac, twenty grains of extract of hyoscyamus, and ten grains of extract of nux vomica, is to be made into twenty pills. The signa must also be read in the light of “obvious intention.” The reading is clearly, “Take *on* going to bed.” But the taking of twenty pills must be instantly dismissed from consideration, and the successful guess is then made that the “e” of the one has been flourished out of existence, and that the intended reading is, “Take *one* going to bed.”

Fig. 535



Carelessly written prescription

Fig. 536

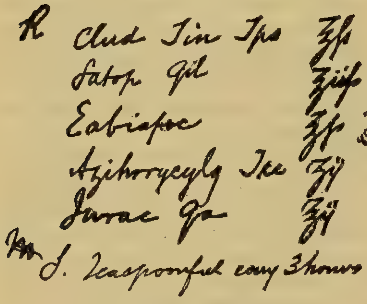


℞ Hyd. Bichlor gr i
Pot Iod
Fer et Am Cit } āā ʒiij
Tinct Cinch Co ℥iss
M ft
Sumat drachmam
ter in die
S
2716

Incompatible prescription

Prescription 536 has been contrived with a disregard of the laws of chemical and physical incompatibility. Precipitation takes place, and this is due to the formation of mercuric potassium iodide, the alkaloidal reagent (see page 1503), and its reaction with the alkaloids in the compound tincture of cinchona. In addition to this, the quantity of ferric citrate is excessive. The prescriber may have intended to add sufficient water to effect a solution and then have forgotten to do so. The only course left for the pharmacist, if unable to communicate with the prescriber, is to dissolve the mercuric chloride in the compound tincture of cinchona with the aid of sufficient potassium iodide. This disposes of the dangerous ingredient. Then having reduced to powder the remaining solids, they are to be added and the prescription dispensed with a shake label, without filtering. There would be no impropriety in directing the patient to take the teaspoonful of medicine with water, and in this way the excess of soluble salts could be dissolved; but by far the best procedure would be to have the prescriber alter the prescription. One grain of mercuric chloride and three drachms each of potassium iodide and ammoniated ferric citrate are to

Fig. 537



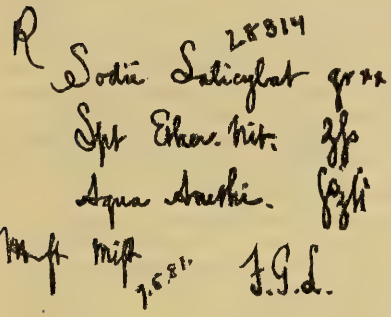
Travestied prescription

be dissolved in one and one-half ounces of compound tincture of cinchona. Let one drachm be taken three times daily.

Prescription 537 is an illustration of a travestied prescription, the intention being to mask its meaning so that only the initiated may be able to unravel its mystery. The method selected here is very simple, consisting in writing the names of the ingredients backward, and with this key the reading is very simple,—half an ounce of sweet spirit of nitre, two and a half ounces of solution of potassa, half an ounce of copaiba, two drachms of extract of licorice, and two ounces of caraway water are to be made into a mixture.

Prescriptions like the one shown in Fig. 538 are common, and they cause a great deal of trouble,—twenty grains of sodium salicylate, half a drachm of spirit of nitrous ether, and two fluidounces of dill water. Owing to some decomposition between the nitrous compounds of the spirit of nitrous ether and the salicylic acid in the sodium salicylate, the nature of which is complicated and has never been determined, a darkening in color which eventually results in the formation of a blackish deposit takes places and the odor of oil of wintergreen is observed. The annoyance to the dispenser in a case of this kind is apt to be considerable; the patient noticing a change in the appearance of the medicine, and at once suspecting that some mistake has been made, takes it to the pharmacist, and no matter how complete the defence may be, nor how earnest the latter may be in his protestations that no mistake has been made, it is only with great difficulty that an unfavorable opinion of the pharmacist's ability can be averted. Previous knowledge on the part of the dispenser that such combinations produce such mixtures would lead to the return of the prescription to the physician, with the request that it may be modified so that the two offending substances may be given separately. If this cannot be done, the prescriber should be notified as soon after the delivery of the prescription as possible, so that the medicine for the patient may be changed at the next visit.

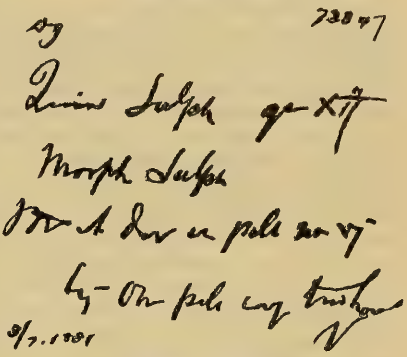
FIG. 538



28314
℞ Sodii Salicylat gr xx
Spt Ether. Nit. ʒss
Aqua Anethi ℥ij
M ft Mist 1.8.81 J.G.L.

Incompatible prescription

FIG. 539

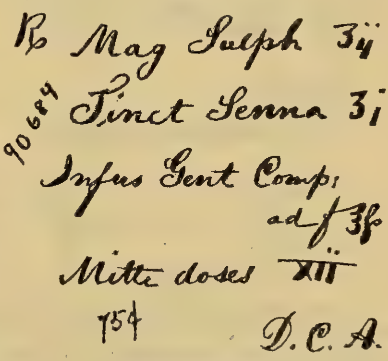


℞ 73847
Quin Sulph gr xij
Morph Sulph
M & div in pils no vj
Sig— One pill every two hours
9/7.1881 V

Deficient prescription

Fig. 539 shows a facsimile prescription in which the quantity of one of the ingredients is omitted. It is presumed that the physician intended to write "gr. i" after "Morph. Sulph.," but it would not be proper for the pharmacist to insert the quantity upon his own judgment, except in case of an extreme emergency which would require prompt action without the advice of the prescriber.

FIG. 540



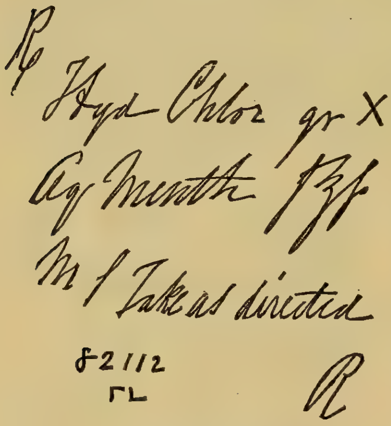
℞ Mag Sulph ʒij
90624 Tinct Senna ʒi
Infus Gent Comp:
ad f℥ss
Mitte doses XII
154 D. C. A.

Faulty prescription

No fault can be found with the legibility of prescription 540. The first line could only be translated "Magnesii Sulph.;" the termination to "Senna" is, however, incorrect, as it should have the genitive termination "æ" instead of "a." Two drachms of sulphate of magnesia, one drachm of tincture of senna, and sufficient compound infusion of gentian to make half a fluidounce. Send twelve doses. Although the additional word "tales" is omitted in the directions, it is a fair inference that the prescriber wants the patient to take half a fluidounce for a dose; but the quantity of liquid is insufficient, and a portion of the sulphate will not dissolve. If the mixture is heated the excess will disappear, only to return on cooling in the form of a gelatinous precipitate. The usual course of notifying the physician should be followed if there is time, and if there is not, there would be no impropriety *in this case* of adding just sufficient water to hold the sulphate in solution, making each dose a little larger, and then sending word to the physician of the fact.

Prescription 541 is a facsimile of one which is ambiguous in two particulars: "Hyd. Chlor." may mean hydrated chloral, calomel, or corrosive sublimate (see page 1597), and "Aq. Menth" may mean peppermint water or spearmint water. "Obvious intention" in this case is the deciding factor, and this apparently points to the conclusion that a soothing draught is intended of chloral hydrate and mint water. The directions, "Take as directed," should cause the pharmacist to pause. In this case, however, a dose of calomel was intended, with mint water as the vehicle. These facts were developed only by a few questions which were asked the patient, who happened to present the prescription personally and who without much provocation said that he was "that bilious" that the doctor had given him "the same medicine as before, for it did him so much good." Further inquiry developed the fact that this was "obvious intention" on the part of the prescriber, and it would have been a very poor conjecture to use chloral hydrate. The incident points clearly to the necessity for the possession of wisdom and caution almost supernatural if errors in judgment are always to be avoided. The use of spearmint or peppermint water when "Aq. Menth." is prescribed is largely a matter of local habit; in some sections mint water always means peppermint water; in other parts of the country spearmint water is preferred. Where local preference does not exist, the fact of the kind of mint not being specified would give the pharmacist an undoubted right to use either. In every case like this a marginal note should be made on the prescription, so that in case of renewal the same mint water may be used that was employed at first.

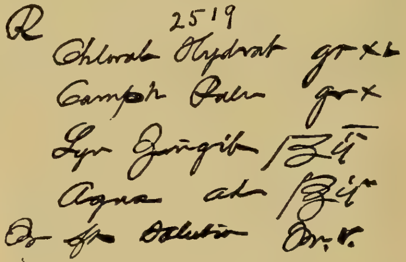
FIG. 541



℞
Hyd Chlor gr X
Aq Menth f℥ss
M / Take as directed
8 2112
FL
R

Ambiguous prescription

FIG. 542



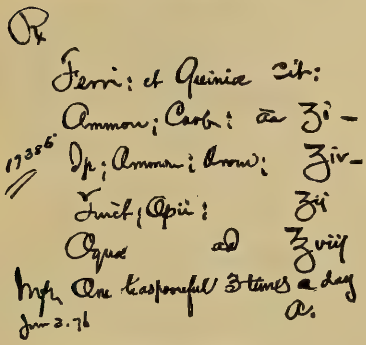
℞ 2519
Chloral Hydrat gr xl
Camph Pulv gr x
Syr Zingib f℥ii
Aqua ad f℥ii
Ds ft. Solution Dr. V.

Incomplete prescription

In prescription 542 there is an opportunity for the dispenser to utilize his knowledge and skill. Forty grains of hydrated chloral, ten grains of powdered camphor, and two fluidrachms of syrup of ginger are to be made into a solution, with sufficient water to make two fluidounces. Hydrated chloral and camphor, when rubbed together, form a liquid (see Chloral Camphoratum, Part VI). If advantage of this knowledge is taken by the dispenser, and if the two substances are rubbed in a mortar until a smooth mixture results, and if half a drachm of powdered acacia be added, with sufficient water to make a smooth mixture, and followed with the remainder of the water and syrup, it will be found that the camphor can be uniformly distributed in the mixture with no tendency to separate. The directions to "make a solution" are faulty, because a *solution* cannot be made with the ingredients named; but the pharmacist is justified in adding acacia to make a mixture, for otherwise the camphor will separate and cannot be combined uniformly.

Prescription 543 exhibits chemical incompatibility. Iron and quinine citrate should never be prescribed with alkaline salts; an excess of the latter will surely decompose the quinine salt, causing precipitation of the alkaloid. The prescriber evidently intends in this prescription to get the tonic effects of the quinine and iron, the sedative properties of the tincture of opium, and the correcting and stimulating influence of the compounds containing ammonia; but in attempting to get all of them bottled up in one mixture he has defeated his purpose,—the alkaloidal salt should either be made into pills or given in a separate preparation. One drachm each of iron and quinine citrate and ammonium carbonate is dissolved in water, aromatic spirit of ammonia, and tincture of opium, with sufficient water to make an eight ounce mixture.

FIG. 543

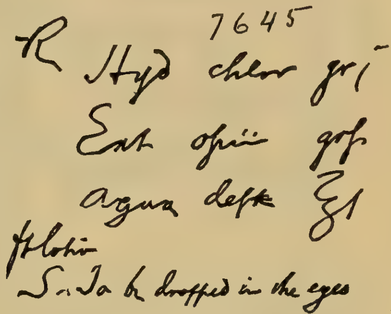


℞

Ferri: et Quiniæ cit:
Ammon: Carb: āā ʒi –
17386 Sp: Ammon: Arom: ℥iv –
Tinct: Opii: ʒii
Aquæ ad ℥viij
Mft. One teaspoonful 3 times a day
Jun 3.76 A.

Incompatible prescription

FIG. 544

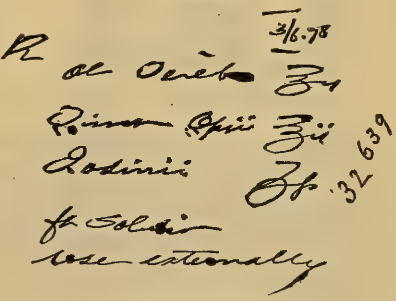


7645
℞ Hyd chlor gr i
Ext opii gr ss
Aqua dest ℥i
ft lotio
S. To be dropped in the eyes

Faulty abbreviation

Prescription 544 is another illustration of incorrect abbreviation. "Obvious intention" cannot be used here to aid in the interpretation, because the intention is *not obvious* by any means. A prescriber might want corrosive sublimate, calomel, or hydrated chloral. Most pharmacists would probably guess that corrosive sublimate was intended, particularly since its use in collyria is not uncommon. But the physician in this case wanted calomel, as he had conceived the idea of replacing the practice of blowing calomel into the eyes (which is sometimes resorted to) by the more refined method of making a lotion and dropping a portion of it into the eyes. One grain of calomel and half a grain of extract of opium are to be made into a lotion with one ounce of distilled water, care being taken to paste a shake label upon the bottle. As a matter of practice it is very doubtful whether the heavy powder calomel could be distributed so uniformly through the lotion that one drop would contain the same proportion that another would.

FIG. 545

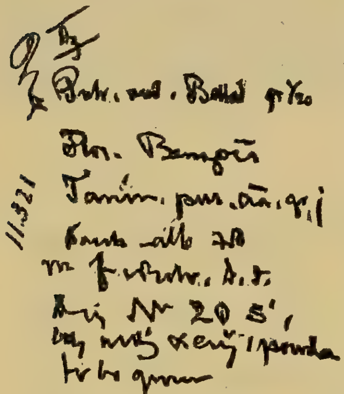


3/6.78
℞ ol Tereb ℥i
Tinct Opii ℥ii
Iodinii ʒss. 32639
ft Solutio
Use externally

Incompatible prescription

In prescription 545 the prescriber intends that a solution should be made,—for he has written "ft. solutio;" but he is no doubt ignorant of the fact that iodine is not soluble either in tincture of opium or in oil of turpentine. If the prescription is compounded as written, considerable irritation will be produced from the contact of the undissolved particles of iodine with the skin. If four drachms of the oil of turpentine be replaced by strong alcohol, and as much of the iodine dissolved in this as can be, and if the moist residue be then rubbed into a smooth paste and the oil of turpentine and tincture of opium added gradually and alternately, a mixture will result in which the undissolved iodine will be in a very fine state of division. The best course to pursue would be to get the physician to use extract of opium, iodine, potassium iodide, and water as a substitute, or a mixture of tincture of iodine and tincture of opium. Incidentally, it may be mentioned that the legibility of a prescription is often seriously impaired by the careless habit of folding it before the ink is dry. This one has been blotted, though not very seriously.

FIG. 546



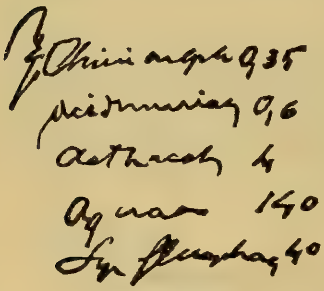
German prescription

Fig. 546 shows a facsimile of a prescription written by a German physician. It is shown for the sake of practice for those unaccustomed to this kind. One-twentieth of a grain of powdered belladonna root, one grain each of benzoic acid and pure tannin, and sufficient white sugar. Make into a powder. Send twenty such powders. Every morning and evening one powder to be given.

Fig. 547 is a facsimile of another German prescription. This one is metric, and is to be compounded according to the German method, by *weighing the liquids.* It is badly written, the last ingredient being very indistinct. Thirty-five centigrammes of quinine sulphate, sixty centigrammes of hydrochloric acid, four grammes of acetic ether, one hundred and forty grammes of water, and forty grammes of syrup of orange flowers (fl. naphæ).

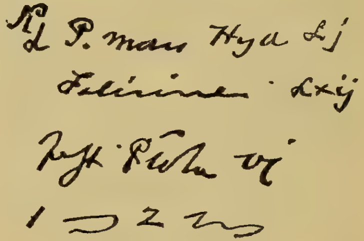
Prescription 548 shows peculiarities of composition that are strongly marked, the character selected for "gr." being unusually bad,—the habit of starting the "g" above the line and slurring the "r" making a character which resembles a capital script letter "L," or the one used to designate the British pound sterling, £. Whether to make six pills or six powders might cause the pharmacist a moment's hesitation, as the directions, "M. ft. pulv vi," are a little ambiguous. But the first line is an aid here. No prescriber would be likely to direct powdered mercurial mass if pills were intended, and it is therefore clear that six powders are wanted. The signa is not difficult for an experienced compounder to interpret: the flourish after "1" would be guessed to mean "every," and that after "2" to mean "hours."

FIG. 547



German prescription

FIG. 548

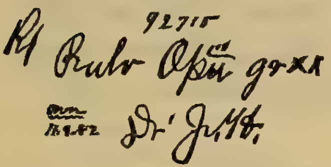


Badly written prescription

Fig. 549 is a dangerous prescription. The absence of any directions and the use of the abbreviation "Dr." before the initials would lead a cautious pharmacist to suspect that this is a forged prescription, written by an opium eater for the purpose of obtaining his dose without difficulty or questioning. There are a few physicians who use their abbreviated title "Dr." before their initials, but it is not common except in certain localities, and an opium eater wanting his dose would be very likely to put "Dr." before the initials, imagining that such an act would lull the suspicions of the pharmacist and thus his object be more readily accomplished; but a trick like this is very apt to overshoot the mark. Advantage may be taken of the fact that no directions have been given with the prescription, and if it is returned to the alleged patient with the request that the doctor write the directions upon it the difficulty can be easily met, or an offer may be made to send to the doctor for the information. If it is a forgery, the behavior of the patient will be apt to reveal it; he will probably take the prescription away and never return. On the other hand, if it is an honest prescription, both doctor and patient can but commend the caution and discretion of the pharmacist.

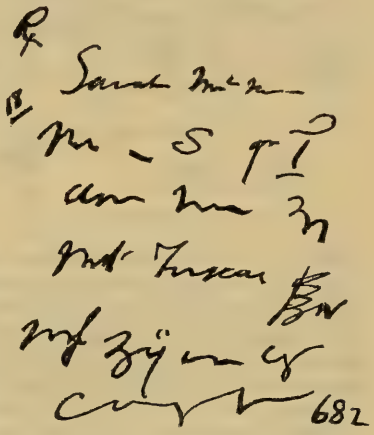
Prescription 550 is an illustration of one written by a dispensary physician "on the jump." To a pharmacist accustomed to such scrawls they present no terrors, but the uninitiated are often sadly mistaken in their interpretations. This prescription is not so illegible as some others of its class in the author's collection, but it has been selected to show that dangerous poisons are sometimes prescribed in this very reckless fashion. Poor "Sarah McM." is expected to obtain relief for her cough by taking "two drachms" of a mixture made of one grain of morphine sulphate, one drachm of "muriate of ammonia," and four ounces of brown mixture (Mist. Fuscæ).

Fig. 549


92715
Pulv Opii gr xx
Dr J

Forged prescription

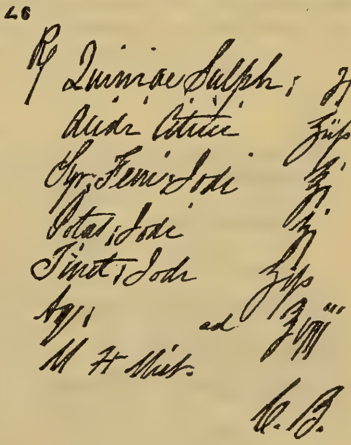
Fig. 550


682

Illegible prescription

In prescription 551 will be seen an illustration of an almost hopeless case of incompatibility. There are no difficulties about making a solution of the quinine sulphate in sufficient water with the aid of the large quantity of citric acid ordered. If the potassium iodide, syrup of ferrous iodide, and tincture of iodine are now added, a reddish precipitate occurs, which probably consists largely of insoluble quinine iodide. The addition of two ounces of mucilage will not only be admissible, but even beneficial as an aid in holding up the precipitate and in blunting the edge of the excess of acid. Quinine sulphate should never be prescribed in combination with iodides, and particularly with excess of iodine; and the physician should be asked to revise such a prescription.

Fig. 551


46
Quiniae Sulph.
Acidi Citrici
Syr. Ferri Iodid.
Potas. Iodid.
Tinct. Iodi
Aq. ad
M. Ft. Mist.
C. B.

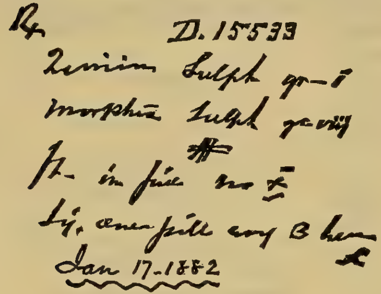
Incompatible prescription

Fig. 552 is a facsimile of a prescription which should at once arouse the cautionary instinct of the compounder. It reads, "One grain of quinine sulphate, eight grains of morphine sulphate; make into ten pills. One pill every three hours." Through a lapsus the prescriber has written the quantity intended for the quinine sulphate after the morphine sulphate, and *vice versa*. The usual rule should be followed.

Gain time, if possible, and notify the physician; if this cannot be done, take the risk, use safe quantities, and inform the prescriber.

In Fig. 553 there is shown a prescription which affords an illustration of chemical incompatibility. Quinine salicylate is not a very soluble salt, and when strong solutions of quinine sulphate and sodium salicylate are mixed, quinine salicylate precipitates. The prescriber has evidently added diluted sulphuric acid with the view of dissolving the quinine salt, but the excess of acid will decompose the sodium salicylate, producing sodium sulphate and throwing out the salicylic acid, which is not very soluble in aqueous liquids. The directions of the prescriber—"ft. solutio," make a solution—cannot be complied with literally. Of course he should be consulted; but, if this is not possible, it would be a fair inference that the diluted sulphuric acid was intended solely for its action on the quinine sulphate to increase its solubility; but, as it acts as an impediment by decomposing the sodium salicylate, it might be omitted. If this course is not permissible, the mixture should be made in a mortar and the clear liquid then separated from the precipitate; the latter may be rubbed into a smooth paste with the aid of some mucilage of acacia and mixed with the rest of the liquid. This will make a mixture, and it should be dispensed with a shake label.

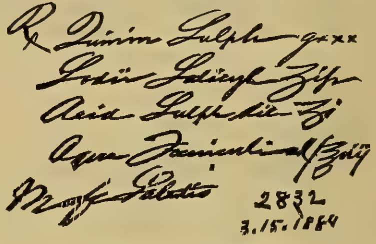
Fig. 552



Rx D. 15533
Quinin Sulph gr–i
morphia Sulph gr viij
ft. in pil no x
Sig. one pill ev'y 3 hrs
Jan 17-1882

Transposed prescription

Fig. 553

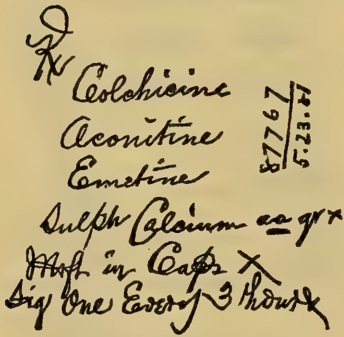


Rx Quinin Sulph gr xx
Sodii Salicyl ʒiß
Acid Sulph dil ʒi
Aqua Foeniculi f℥iij
M. ft. Solutio 2832
3.15.1884

Incompatible prescription

Prescription 554 is a facsimile of one written by a medical student. The ingredients are distinctly indicated; but the dose of the poisonous alkaloids is so heroic and the prescription itself so unusual that very little risk is incurred of the patient being poisoned. No dispenser who would be likely to compound such a prescription would have such alkaloids in stock. The only course to pursue here is to gain time and return the prescription to the prescriber for correction. Ten grains each of colchicine, aconitine, emetine, and calcium sulphate are to be made into ten capsules, and one given every three hours.

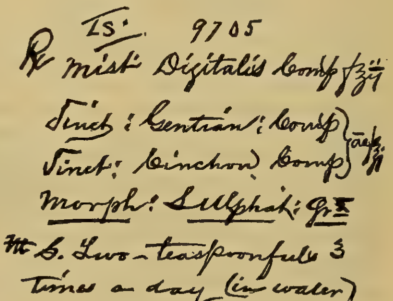
Fig. 554



Rx Colchicine
Aconitine
Emetine
Sulph Calcium aa gr x
Mft in Caps X
Sig One Every 3 Hours
87767
5.23.87

Toxic prescription

Fig. 555

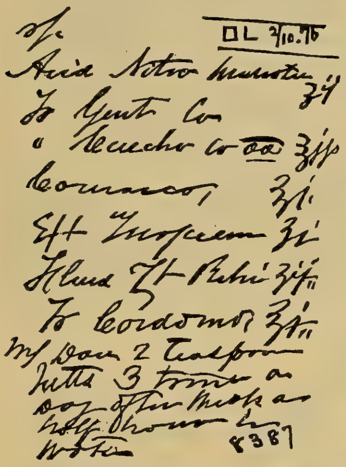


15. 9705
Rx mist: Digitalis Comp f℥ii
Tinct: Gentian: Comp
Tinct: Cinchon Comp aa ℥ij
morph: Sulphat: gr x
M S. Two teaspoonfuls 3 times a day (in water)

Questionable prescription

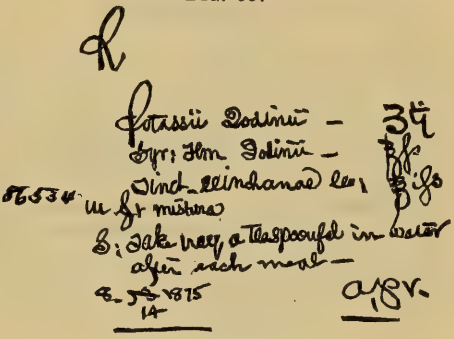
Fig. 555 is a type of a prescription not uncommon. Care and good judgment are required to pilot the compounder through safely. It might be surmised that the first ingredient was intended for "compound infusion of digitalis," but this is not the case,—the "compound mixture" being a preparation devised by the physician and the formula not published, the intention being to send the patient to a special drug store to have it compounded, the druggist, of course, having been previously supplied with the private formula. This practice is common in some localities. It does not follow, however, that the physician always derives a pecuniary consideration through the method, although where the practice prevails both prescriber and compounder are soon suspected of pocketing some special profit. If the physician makes the private formula public or gives the patient the opportunity of going to a large number of pharmacists to whom he has given the formula, he is relieved of what is probably an unjust suspicion. The dose of morphine sulphate is a large one, but the underscoring of the line indicates that the prescriber has considered the likelihood of the compounder's questioning it, and he has underscored the words so that the compounder knows that the prescriber intended to give an unusually large dose. Under the circumstances there is no impropriety in dispensing it. Some careful pharmacists would prefer to decline such a prescription on the ground that they did not have the formula of the private preparation, the real reason being their unwillingness to incur the risk of dispensing so large a dose of morphine sulphate. Formulas for private preparations may often be secured through professional courtesy by applying to the pharmacist known to have them.

FIG. 556



Illiterate prescription

FIG. 557



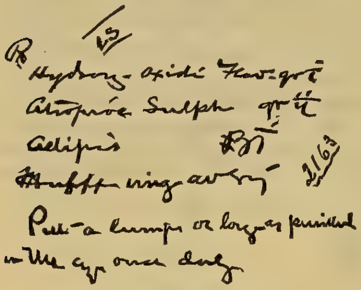
Incompatible prescription

The facsimile Fig. 556 shows the prescription of a physician who at one time had an extensive practice, but whose early education had been seriously neglected. The ingredients are: Two drachms of nitro muriatic acid, one and one-half ounces each of compound tincture of gentian and compound tincture of cinchona, one ounce of Curaçoa cordial, one drachm of extract of taraxacum, two drachms of fluidextract of rhubarb ("rehi"), one ounce of tincture of cardamom. Dose, two teaspoonfuls, three times a day, after meals a half hour, in water.

Prescription 557 illustrates two kinds of incompatibility. Two drachms of potassium iodide, half a fluidounce of syrup of ferrous iodide, and one and one-half fluidounces of compound tincture of cinchona are to be made into a mixture. Take half a teaspoonful in water, after each meal. Potassium iodide is usually crystallized by the manufacturer from an alkaline solution, and traces of the potassium hydroxide which is present in the mother liquor are retained by the crystals. The hydroxide by contact with the air, containing carbonic acid, becomes potassium carbonate, and hence commercial potassium iodide always contains traces of carbonate, and the Pharmacopœia permits the presence of 0.1 percent. of alkali. Hence it follows that when a solution of potassium iodide is brought in contact with syrup of ferrous iodide a greenish flocculent precipitate is produced which is ferrous carbonate. This may be filtered out without detriment to the prescription. The other instance of incompatibility is inexcusable. Iron salts produce with preparations of cinchona bark blackish, inky precipitates, due to the reaction between the tannin in the cinchona and the ferrous iodide. Filtration will not remedy this fault, and there is usually no recourse but to dispense the prescription with a shake label.

In prescription 558 the principal interest centres in the directions to the patient. One grain of yellow mercuric oxide, two grains of atropine sulphate, and one drachm of lard are to be made into an ointment. The prescriber intends that the patient should "put a lump as large as a *pin's head* in the eye once daily." If the label had been written according to the first reading of the compounder,—*i.e.*, put a lump as large as a *peanut* in the eye, etc.,—there would undoubtedly have been a serious time for all,—patient, physician, and pharmacist.

Fig. 558

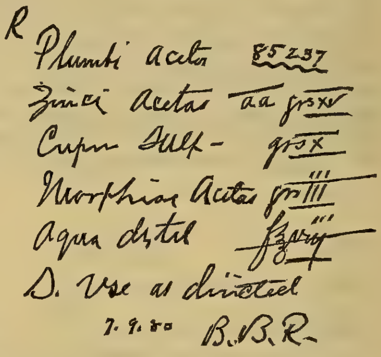


℞ Hydrarg. oxidi Flav. gr. i
Atropine Sulph. gr. ii
Adipis ʒi
[illegible]
Put a lump as large as pinhead in the eye once daily
2163

Badly written prescription

Chemical incompatibility is illustrated in Fig. 559, and while the compounder may believe that the prescriber has erred, through ignorance of the fact that sulphates are delicate reagents for lead salts, the absence of directions for use makes it impossible for him to obtain any clue. The presence of lead sulphate may have been expected and desired by the physician. In such cases the only course is to compound the prescription exactly as it is written and dispense it, without filtering, with a shake label. Fifteen grains each of lead acetate and zinc acetate, ten grains of copper sulphate, and three grains of morphine acetate are to be dissolved in eight fluidounces of distilled water. Use as directed.

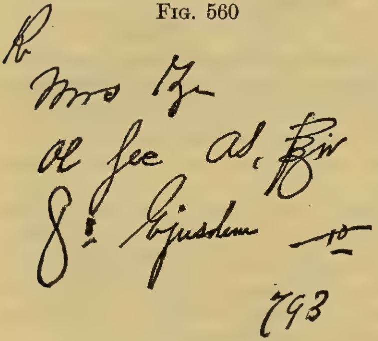
Fig. 559



℞ Plumbi Acetas 85237
Zinci Acetas āā grs xv
Cupri Sulf. grs x
Morphiae Acetas grs iii
Aqua distil f℥viii
D. Use as directed
7. 9. 80 B. B. R.

Incompatible prescription

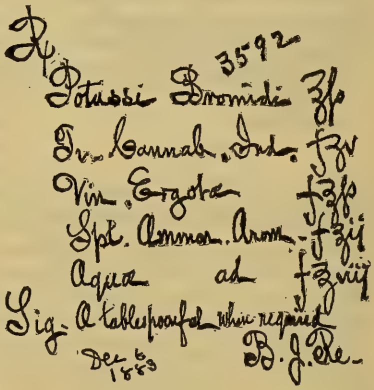
Fig. 560



℞ Mrs Z
Ol. Jec. As. ℥iv
S. Ejusdem
10
793

Curious prescription

Fig. 561



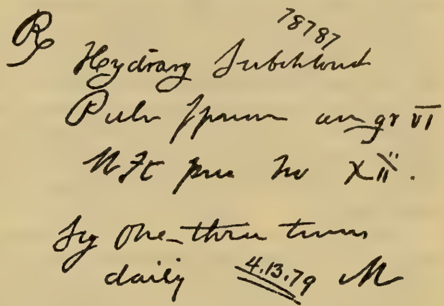
℞ 3592
Potassii Bromidi ℥ss
Tr. Cannab. Ind. fʒv
Vin. Ergotæ f℥ss
Spt. Ammon. Arom. fʒij
Aqua ad f℥viij
Sig. A tablespoonful when required
Dec 6 1883 B. J. Re.

Legible prescription

Fig. 560 shows peculiarity and brevity. It is expected that Mrs. Z. will receive four fluidounces of cod liver oil and that the bottle will be labelled the same. Oleum Jecoris Aselli is one of the synonyms for Oleum Morrhuæ, and the Latin word "Ejusdem," used in this connection, is a short but peculiar way of directing the compounder how he is to label the bottle.

Although prescription 561 is rather flourishing in its style, no fault can be found with its legibility. Half an ounce of potassium bromide, five fluidrachms of tincture of cannabis indica, half a fluidounce of wine of ergot, two fluidounces of aromatic spirit of ammonia, and sufficient water to make eight fluidounces. The chief interest in it is due to the presence of the tincture of cannabis indica. If the prescription be compounded without this, and if a drachm of granulated acacia be placed in a mortar and rubbed with sufficient of the liquid to form a thick paste and the tincture then gradually and slowly added, it will be found that the resinous matter in the cannabis can be uniformly suspended, and when this is mixed with the rest of the liquid a very satisfactory preparation will have been produced. It should of course be dispensed with a shake label.

FIG. 562

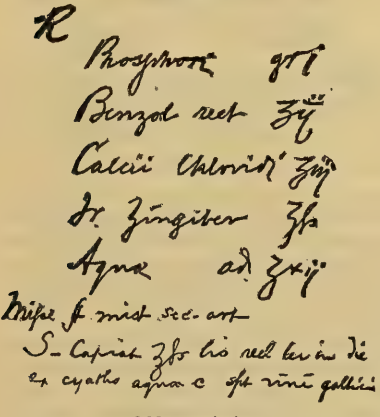


℞ 78787
Hydrarg Subchlorid
Pulv Ipecac aa gr vi
M ft pu No xii.
Sig One three times
daily 4.13.79 M

Questionable prescription

Fig. 562 is a facsimile of a prescription written by an old practitioner. Hydrargyri subchloridum is rather an old name for calomel, but not uncommon. Six grains each of calomel and powdered ipecac are to be made into either twelve pills or twelve powders, and the question is, which? A little study of the prescriber's method shows that he has fortunately acquired the habit of dotting his "i's," and it is fair to presume that if pills were intended he would have dotted the "i" in the word. M. ft. *pul.* No. xii. is undoubtedly the correct reading. A few suggestive questions to the patient, such as—"Did the doctor direct you to take water with these?" or, "Were these to be taken after meals?" will be apt to elicit such a reply as this: "Yes, he said that I should take one *powder* three times a day, just before meals."

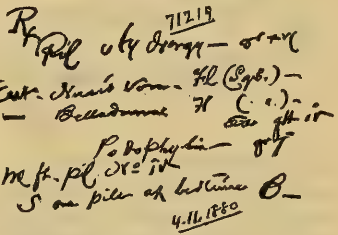
FIG. 563



℞
Phosphori gr i
Benzol rect ℥ii
Calcii Chloridi ℥ij
Tr Zingiber ℥ss
Aqua ad ℥xij
Misce ft mist sec. art
S. Capiat ℥ss bis vel ter in die
ex cyatho aquae c spt vini gallici

Odd prescription

FIG. 564



℞ 71219
Pil Hydrarg— gr xvi
Ext. Nucis Vom. Fl (Sqb.)—
— Belladonnae Fl (")—
āā gtt iv
Podophyllin— gr i
M ft pil No iv
S one pill at bedtime B—
4.16.1880

Faulty prescription

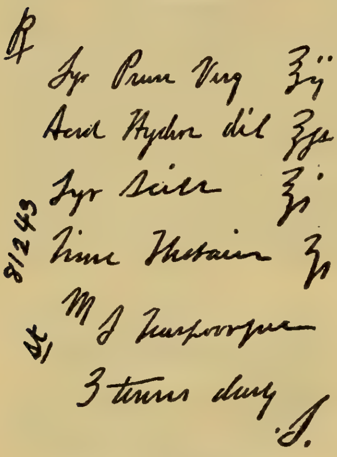
Prescription 563 belongs to a class fortunately rare. The intention of the prescriber is undoubtedly to give phosphorus in a fine state of division, suspended in the mixture. This may be accomplished by dissolving the phosphorus in the benzene (not petroleum benzin), and, having made a thick mucilage of acacia from one drachm of gum, the solution of phosphorus may be gradually added with stirring, followed by the tincture of ginger and the chloride of calcium, dissolved in a little water. The directions to the compounder—Misce, ft. mist. sec. art. (make a mixture according to art)—indicates that the prescriber offers the pharmacist an opportunity to exercise his skill in making a good mixture. The directions for the patient are in Latin, the translation being,—"Let him take half a fluidounce, two or three times daily, in a cup of water, with brandy."

Fig. 564 is a facsimile of a prescription written by a prescriber of large experience. Sixteen grains of mercurial mass, and one grain of podophyllin, with four drops each of fluidextract of nux vomica and fluidextract of belladonna (Squibb's), are to be made into four pills. As blue mass is usually soft in consistence, it will be necessary to evaporate the fluidextracts. This may be easily done by heating a small mortar, and, after dropping the fluidextracts into it and stirring them a short time with the pestle, the blue mass and podophyllin can be subsequently added and four pills made from the mass. The reason for prescribing fluidextracts when extracts are available is not apparent.

Fig. 565 shows a prescription which is faulty in several respects. In the second line the abbreviation is questionable. Is diluted hydrochloric or diluted hydrocyanic acid desired? It would be fair to assume that diluted hydrocyanic acid is wanted, because of its action as a sedative, and that it is undoubtedly a cough mixture and the prescriber desires to reinforce the action of the syrup of wild cherry. The style of writing is anything but legible, and the use of an unusual term for "opium" in the fourth line adds to the difficulties. Two ounces of syrup of wild cherry, half a drachm of diluted hydrocyanic acid, one ounce of syrup of squill, and one drachm of tincture of opium (tinctura thebaicæ). Teaspoonful three times daily.

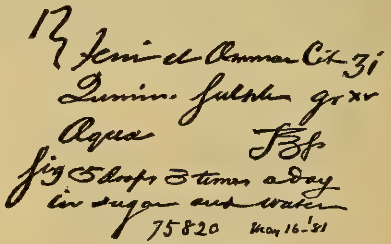
Prescription 566 brings up an interesting question about which there may be more than one opinion. One drachm of iron and ammonium citrate and fifteen grains of quinine sulphate are to be made into a solution with half a fluidounce of water, and five drops are to be taken three times a day, in sugar and water. If no acid be used, it will not be easy for the patient to comply with the prescriber's directions to take five drops, for the insoluble portion of the quinine sulphate will separate, and the dropping, if each drop is to contain its proper proportion of quinine, will be very defective. If the directions were different and the patient could secure a fair dose each time, it probably would be best not to make an addition of acid; but in this case there could be no impropriety in making a solution of the quinine sulphate in the water with a trace of acid (citric acid, if preferred), and then dissolving the iron and ammonium citrate in the solution. The practice of adding acids or alkalies to prescriptions generally and upon very little provocation is a bad one, and the author would not be understood as encouraging the habit; but occasions occur when there should be no hesitation about employing a trace of acid or alkali when the compounder is satisfied that the intention of the prescriber will not be frustrated. Of course the risk of making an error in judgment must be taken; but "first be sure that you are right, and then—do right."

FIG. 565


℞
Syr Prun Virg ℥ij
Acid Hydr dil ʒss
Syr Scill ℥i
Tinc Thebaic ʒi
M S Teaspoonful
3 times daily
J.
8/243

Badly written prescription

FIG. 566

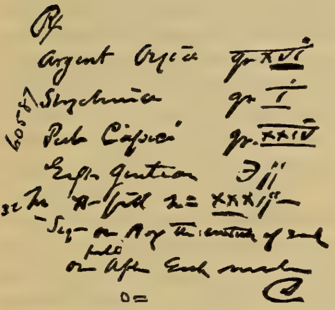

℞ Ferri et Ammon Cit ʒi
Quinin Sulph gr xv
Aqua f℥ss
Sig 5 drops 3 times a day
in sugar and water
75820 May 16 '81

Imperfect prescription

Fig. 567 is a facsimile of a prescription for pills. Sixteen grains of silver oxide, one grain of strychnine, twenty-four grains of powdered capsicum, and forty grains of extract of gentian are to be made into thirty-two pills. If these pills are made in the ordinary way, with an excipient of syrup, glucose, or similar liquid, the pills will be very apt to explode, owing to the decomposition of the silver salt. The directions are not very legible, but it is not difficult to read,—Sig. on box the contents of *each* pill. One after each meal. The prescriber would probably be satisfied if the contents of *one* pill were written on the label; he certainly does not intend that the contents of *thirty-two* pills be so written, although this is what he directs.

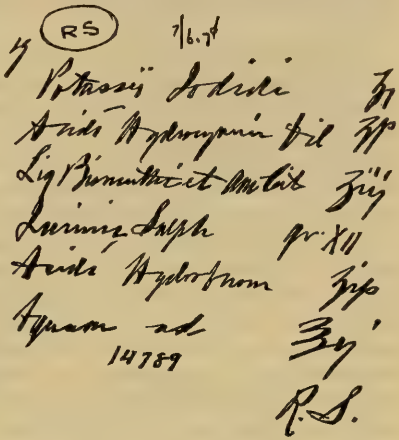
Prescription 568 is a strange mixture, thrown together in opposition to the laws of chemical combination and compatibility. The quinine will be precipitated through the formation of a double bismuth and potassium iodide,—a precipitant for alkaloids, sometimes used as a reagent. The presence of the hybrobromic acid aids in the precipitation, instead of dissolving the precipitate. The translation is, —One drachm of potassium iodide, half a drachm of diluted hydrocyanic acid, three drachms of solution of bismuth and ammonium citrate, twelve grains of quinine sulphate, one and a half drachms of hydrobromic acid, and sufficient water to make two ounces. The only course to pursue is to dissolve the quinine salt in four drachms of water containing the hydrobromic acid, dissolve the potassium iodide in the remainder of the water, and add the other ingredients.

FIG. 567


℞
Argent Oxide gr XVI
Strychnine gr I
Pulv Capsici gr XXIV
Ext Gentian ʒij
M ft pil No XXXII
Sig one pill [illegible]
after each meal

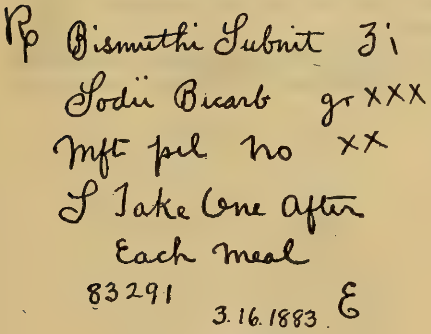
Explosive prescription

FIG. 568


RS 7/6.7
℞
Potassii Iodidi ʒi
Acidi Hydrocyanic dil ʒss
Liq Bismuth et Am Cit ʒiij
Quinine Sulph gr XII
Acidi Hydrobrom ʒiss
Aquam ad ℥ij
14789
R.S.

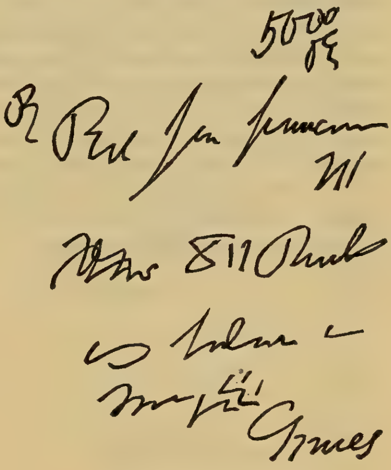
Incompatible prescription

FIG. 569


Rp Bismuthi Subnit ℥i
Sodii Bicarb gr XXX
Mft pil no XX
S Take One after
Each meal
83291 3.16.1883 E

Doubtful prescription

FIG. 570


Illegible prescription

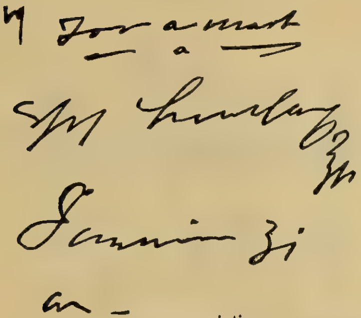
Prescription 569. Pills made from bismuth subnitrate and sodium bicarbonate have been known to explode, owing to decomposition in the sodium bicarbonate from acid in the bismuth salt, carbon dioxide being liberated. Of course no explosion can take place if the pills are not dispensed in a tightly corked vial or other container which will not permit of the escape of the liberated gas. Risk of explosion may be obviated by piercing the lid of the pill box with a few holes ; but the pills may swell to an enormous size, due to the non-escape of the gas.

Prescription 570 is a facsimile of one written by a noted physician. One other specimen of his handiwork may be seen on page 1609. The translation is,—Two drachms of powdered gum guaiacum. Make twelve powders. One taken at night.

In concluding these comments it may truly be said that the necessity for more care in writing prescriptions has been unquestionably proved by abundant evidence. Physicians have in many cases grown careless in this respect, often relying upon the proverbial caution and self interest of the pharmacist to correct errors or supply deficiencies ; while the additional responsibility thus thrust on the compounder has a tendency to develop his faculties, it does not lighten his cares, nor is it labor which is appreciated by the prescriber, who usually regards the service as quite within the routine of the pharmacist's duties, and the latter is expected, as a matter of course, to check errors and decipher scrawls with ease. On the other hand, there are often occasions when great haste must be exercised in writing a prescription ; in addition, it should be remembered that it frequently happens that the physician is harassed by many annoyances and interruptions while writing the prescription. These circumstances, coupled with the gentlemanly instincts which all true pharmacists are credited with possessing, should exercise their proper restraining influences upon the latter while undertaking the mission of interviewing the physician upon a subject which is often mortifying to him. It is impossible to conduct an active business without encountering occasions which require the exercise of much forbearance and tact, and the reflection that both physician and pharmacist are *at all times* human, and hence liable to err, should prevent either from indulging in expressions detrimental to the good name of the other. In the unusual instance of a physician taking umbrage when a judicious course has been followed by the pharmacist in correcting his mistake, a firm and dignified defence should be at once made by the latter, and maintained with spirit, but not in the presence of the patient, if it can possibly be avoided.

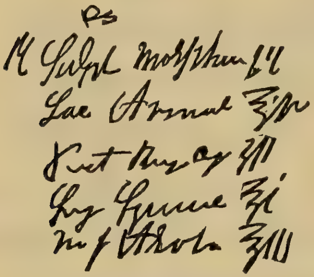
The prescriptions and orders upon the following pages are submitted without comment, with the view of affording the reader an opportunity for individual practice.

Fig. 571



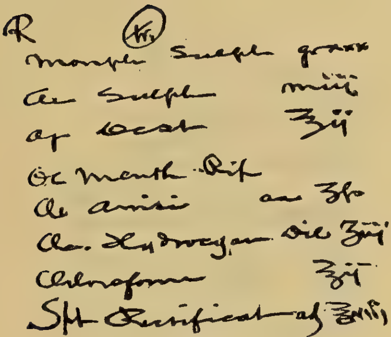
Obscure prescription

Fig. 572



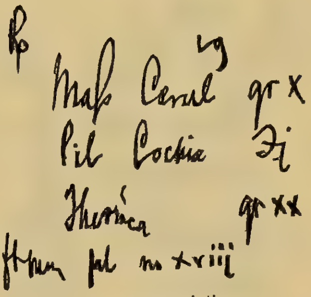
Illegible prescription

Fig. 573



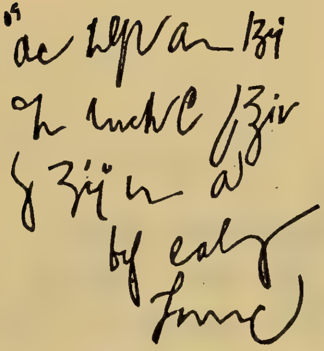
Difficult prescription

Fig. 574



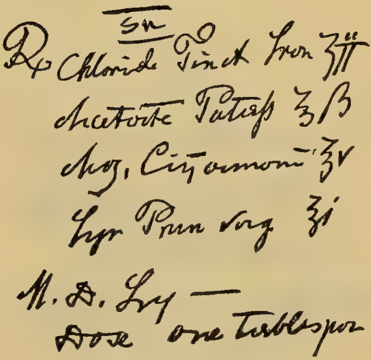
Antique prescription

Fig. 575



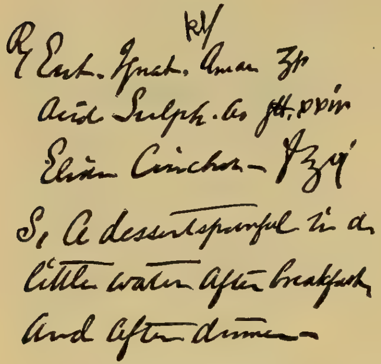
Careless prescription

Fig. 576



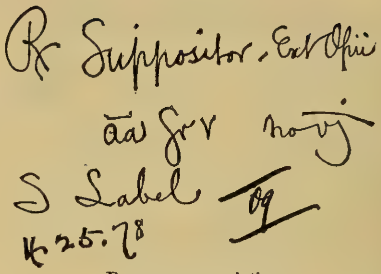
Doubtful prescription

FIG. 577



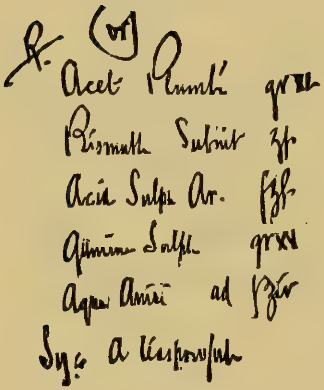
Questionable prescription

FIG. 578



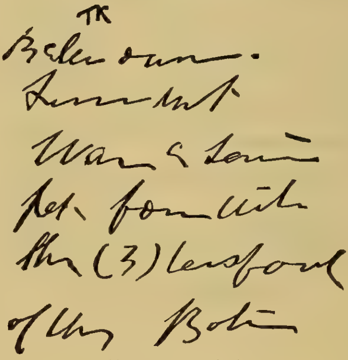
Erroneous prescription

FIG. 579



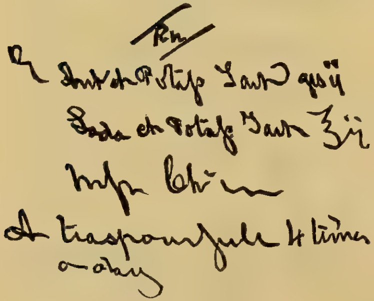
Incompatible prescription

FIG. 580



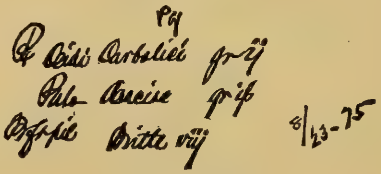
Illegible prescription

FIG. 581



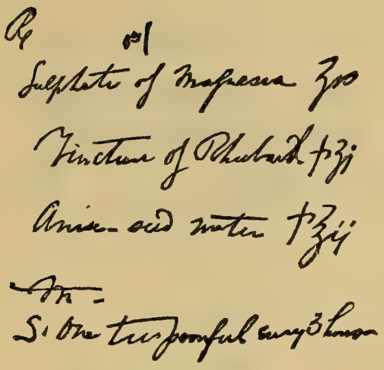
Odd prescription

FIG. 582



Difficult prescription

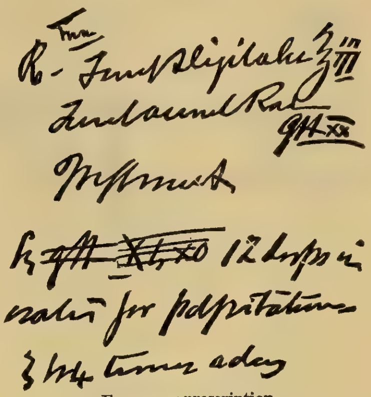
FIG. 583



℞
Sulphate of Magnesia ℥ss
Tincture of Rhubarb f℥j
Anise-seed water f℥ij
M.
S: One teaspoonful every 3 hours

Doubtful prescription

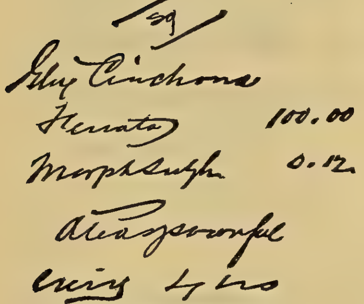
FIG. 584



℞ - Tinct Digitalis ℥iii
Tinct Aconit Rad gtt xx
M ft mixt
S gtt ~~xv, x0~~ 12 drops in water for palpitation 3 to 4 times a day

Erroneous prescription

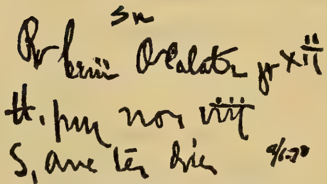
FIG. 585



Elix Cinchona Ferrata 100.00
Morph Sulph 0.12
A teaspoonful every 4 hrs

Metric prescription

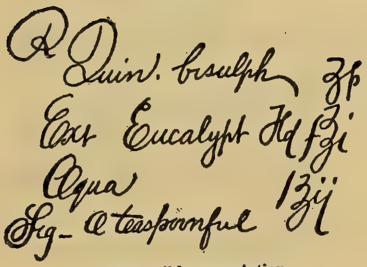
FIG. 586



℞ Ferri Oxalate gr xii
ft. pil no viii
S, one ter die

Questionable prescription

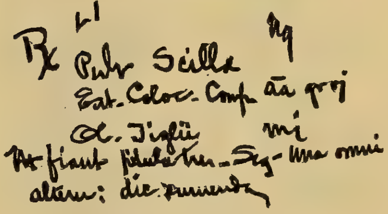
FIG. 587



℞ Quin. bisulph ʒss
Ext Eucalypt Fld f℥i
Aqua ℥ij
Sig - A teaspoonful

Incompatible prescription

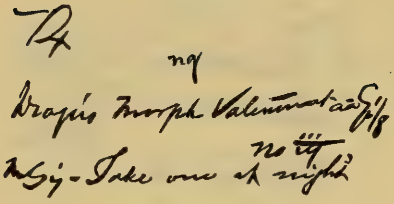
FIG. 588



℞ Pulv Scillæ
Ext. Coloc. Comp āā gr j
Ol. Tiglii ♏ i
M. fiant pilulæ tres. Sig - Una omni altern: die sumenda

Difficult prescription

FIG. 589


Rx

ng

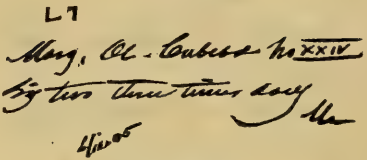
Dragés Morph Valerianat aa gr 1/8

No iij

M Sig - Take one at night

Safe prescription

FIG. 590


L7

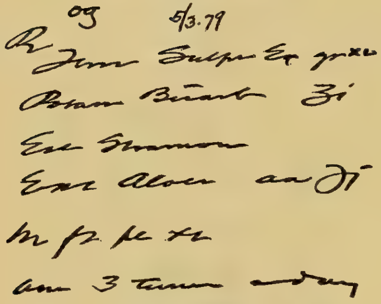
Mag. Ol. Cubebs No XXIV

Sig two three times day

4/iv/05

Unusual prescription

FIG. 591


og 5/3.79

R Ferri Sulph Ex gr xx

Bism Subnit ʒi

Ext Stramon

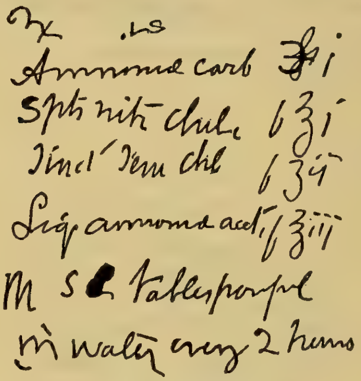
Ext Aloes aa ℈i

M ft pil xx

one 3 times a day

Difficult prescription

FIG. 592


Rx .LS

Ammonia carb ʒi

Spts nitr dulc f ʒi

Tinct Ferri chl f ʒii

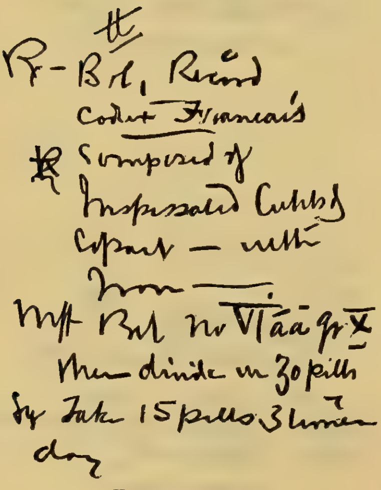
Liq ammon acet f ʒiii

M S a tablespoonful

in water every 2 hours

Incompatible prescription

FIG. 593


tt

Rx - Bol, Record

Codex Français

R Composed of

Inspissated Cubebs

Copaiv — with

Iron —

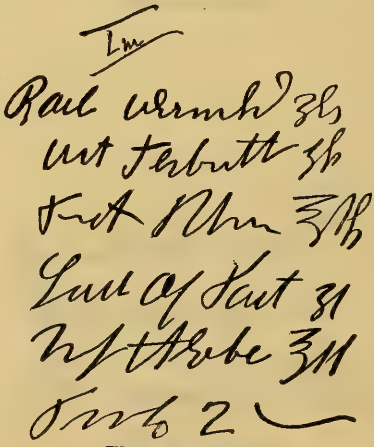
Mft Bol No VI aa gr X

then divide in 30 pills

Sig Take 15 pills 3 times day

Unusual prescription

FIG. 594


Im

Rad Ulmi ʒss

Ext Terbutt ʒss

Fruct Rhamn ʒss

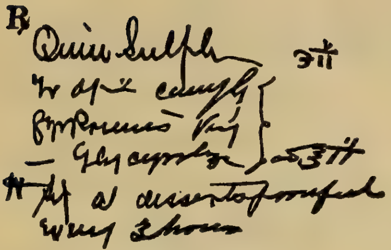
Sal of Tart ʒi

M ft Bolus ʒii

Sig 2

Illegible prescription

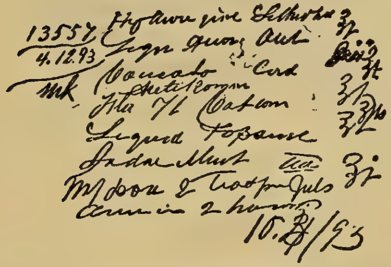
FIG. 595



℞ Quin. Sulph ℈ ii
Tr. Opii camph
Syr. Prunus Virg
Glycyrrhiz āā ℥ ii
M. Ft. A dessertspoonful every 3 hours

Questionable prescription

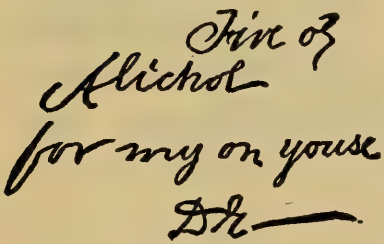
FIG. 597



13557
4.12.93
Mk
[illegible]
[illegible] ʒ i
Cascara [illegible] Cord ʒ i
Ext. Cascara [illegible] ʒ i
[illegible] ʒ 1/6
Liquid [illegible] ʒ ii
Sodae [illegible] āā ʒ i
M. [illegible]
[illegible] in 2 hours
10.[illegible]/93

Badly written prescription

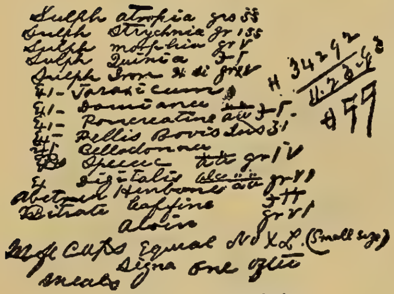
FIG. 598



Five oz
Alichol
for my on youse
Dr

Illiterate order

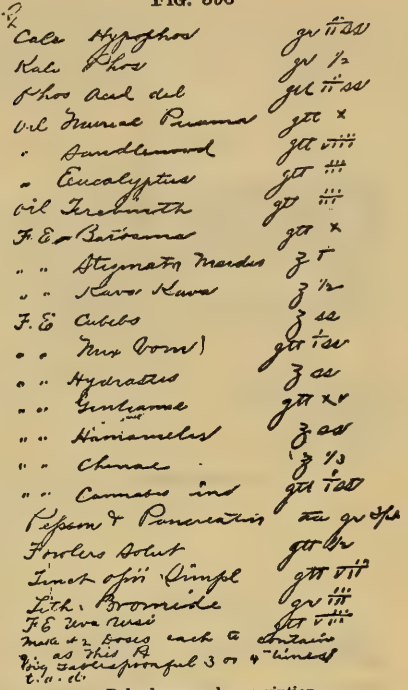
FIG. 600



Sulph atrophia grs ss
Sulph Strychnia gr iss
Sulph morphia gr v
Sulph Quinia ʒ i
Sulph Iron & di gr xv
Ext.- Taraxicum
Ext.- Damiana āā ʒ i
Ext.- Pancreatine āā ʒ i
Ext.- Fellis Bovis āā ʒ i
Ext.- Belladonna
Ext.- Ipecac āā gr iv
Ext.- Digitalis āā gr vi
abetmeh Henbane āā ʒ ii
Citrate Caffine gr vi
aloin
M. ft. Caps Equal No XL. (Small size)
Signa one after meals
H 34292
4.23.93
#77

Polypharmacal prescription

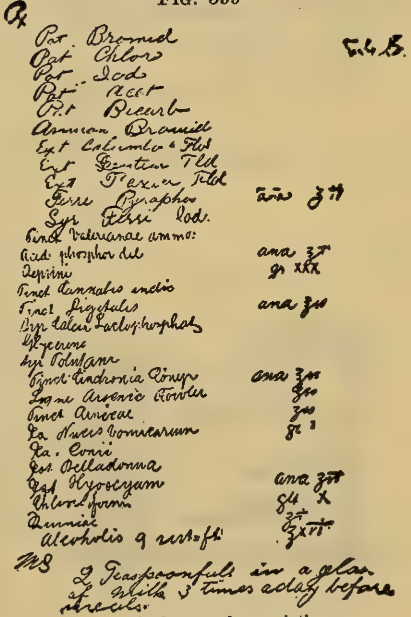
FIG. 596



℞
Calc Hypophos gr ii ss
Kali Phos gr ½
Phos Acid dil gtt ii ss
Oil Oriental Pinanna gtt x
" Sandalwood gtt viii
" Eucalyptus gtt iii
Oil Terebinth gtt iii
F. E. Baroama gtt x
" " Stigmata Maidis ʒ i
" " Kava Kava ʒ ½
F. E. Cubebs ʒ ss
" " Nux Vom gtt i ss
" " Hydrastis ʒ ss
" " Gentianae gtt xv
" " Hamamelis ʒ ss
" " Chinae ʒ ⅓
" " Cannabis ind gtt i ss
Pepsin & Pancreatin āā gr ½
Fowlers Solut gtt ½
Tinct opii Simpl gtt vii
Lith. Bromide gr iii
F E Uva Ursi gtt viii
Make 12 Doses each to contain as this ℞
Sig Tablespoonful 3 or 4 times t. i. d.

Polypharmacal prescription

FIG. 599



℞
Pot. Bromid
Pot Chlor
Pot. Iod
Pot. Acet
Pot Bicarb
Ammon Bromid
Ext Calumba Fld
Ext Gentian Fld
Ext Taraxa Fld
Ferri Pyrophos
Syr. Ferri Iod.
Tinct Valerianae ammo:
Acid phosphor dil
Pepsini
Tinct Cannabis indic
Tinct Digitalis
Syr Calcii Lactophosphat
Glycerine
Syr Tolutani
Tinct Cinchonia Comp
Liquor Arsenic Fowler
Tinct Arnicae
Ta Nucis Vomicarum
Ta. Conii
Ext. Belladonna
Ext Hyoscyam
Chloroform
Quiniae
Alcoholis q. s. ut ft.

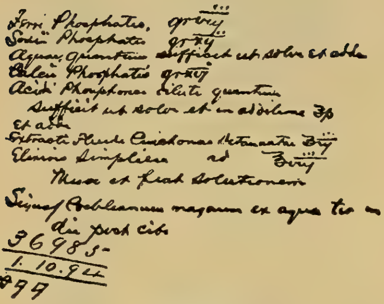
āā ʒ ii
ana ʒ i
gr xxx
ana ʒ ss
ana ʒ ss
ʒ ss
ʒ ss
gtt ii
ana ʒ ii
gtt x
ʒ i
℥ xvi

t. i. d.

M S 2 Teaspoonfuls in a glass of Milk 3 times a day before meals.

Polypharmacal prescription

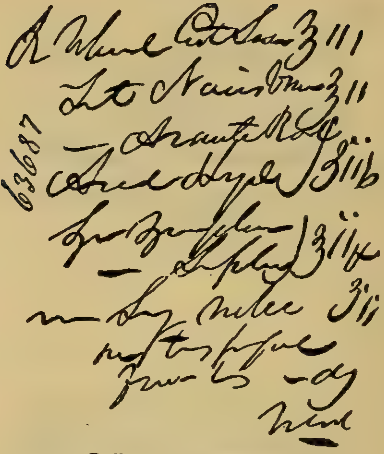
FIG. 601



Ferri Phosphatis. gr viij
Sodii Phosphatis gr xv
Aquae quantum sufficiat ut solv et adde
Calcii Phosphatis gr xvj
Acidi Phosphorici diluti quantum
sufficiat ut solv et in addimus ʒß
Et adde
Extracti Fluidi Cinchonae Detannatae ʒiij
Elixiris Simplicis ad ʒiij
Misce et fiat solutionem
Signa Cochleare magnum ex aqua ter in die post cibos
36985
1. 10. 94
899

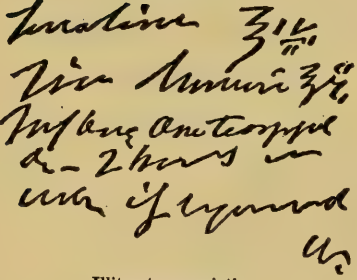
Latin prescription

FIG. 602



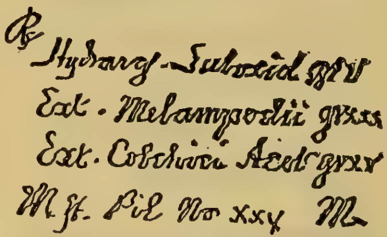
Badly written prescription

FIG. 603



Illiterate prescription

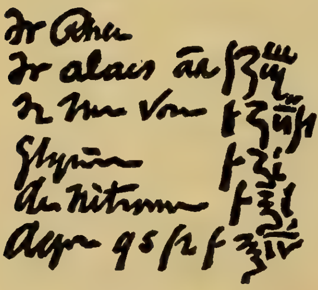
FIG. 604



℞ Hydrarg. Subchlorid gr v
Ext. Melampodii gr xxx
Ext. Colchici Acet gr xv
M. ft. Pil No xxv M.

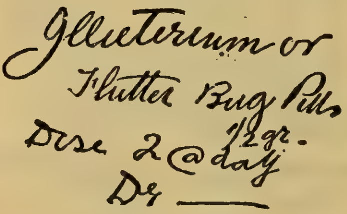
Old fashioned prescription

FIG. 605



Dangerous prescription

FIG. 606



Glleterium or
Flutter Bug Pills
Dose 2 @ day 1/2 gr.
Dr

Illiterate prescription

LATIN PRESCRIPTIONS

A number of Latin prescriptions will be found below, the first ten of which are printed without abbreviations; it is very unusual to receive prescriptions of this kind, nevertheless their translation and study will furnish useful practice.

Translate the following prescriptions, and also the accompanying directions:

1. Recipe Liquoris Ammonii Acetatis, drachmas tres cum semisse;
Vini Antimonii, drachmas duas;
Tincturæ Cardamomi Compositæ, drachmas tres;
Aquæ Menthæ Piperitæ, uncias quatuor.

Fiat mistura, cujus unciæ duæ omni horæ quadrante calefactæ sumendæ, durante frigore.

2. Recipe Rosæ Gallicæ, unciam dimidiam;
Aquæ ferventis, uncias octo.

Stent per horam; colaturæ adde Succi Limonum, Sacchari, ana, quantum sufficit, ad gratam acerbitatem dulcedinemque.

3. Recipe Extracti Colocynthidis Compositi, drachmam unam;
Pulveris Scammonii, scrupulum unum;
Pulveris Gambogiæ, grana quinque.

Misce.—Fiant pilulæ viginti, quarum duæ deglutiantur horâ decubitûs; diluculò, ut infra.

4. Recipe Infusi Sennæ, unciam unam.

5. Recipe Potassii et Sodii Tartratis, sesquidrachmam,
Cretæ Præparatæ, semidrachmam;
Misce.—Fiat pulvis in jusculo tenuissimo sumendus.

6. Recipe Ammonii Carbonatis, grana sex;
Syrupi Aurantii, drachmas duas;
Aquæ, drachmas decem.

Misce.—Fiat haustus, cui, tempore capiendi, adde Succi Limonis recentis cochleare medium unum, et in effervescentiâ sumatur.

7. Recipe Tincturæ Opii, semidrachmam;
Spiritûs Chloroformi, drachmam;
Misturæ Cretæ,
Aquæ Menthæ Piperitæ, ana, uncias tres.

Misce.—Fiat mistura, cujus sumantur cochlearia duo magna post unamquamque sedem mollem, phialâ prius concussâ.

8. Recipe Misturæ Ammoniaci, uncias sex;
Tincturæ Opii, drachmam.

Misce.—Capiat cochlearia duo magna statim; iterentur post horam, si tussis accreverit.

9. Recipe Extracti Belladonnæ Fluidi, drachmam cum semisse;
Lini Farinæ, uncias duodecim;
Aquæ bullientis, quantum sufficit ut fiat cataplasma admovendum calidè loco adfecto.

10. Recipe Cetrariæ, unciam;
Aquæ frigidæ, octarium.

Coque ad uncias duodenas; stet ut geletur, et utatur æger gelatinâ ad libitum.

11. ℞ Magnes. Carb., ʒi;
Pulv. Rhei, gr. xv;
Aq. Anisi, f℥iss.

M.—Fiat julep.[1] cujus unum cochl.[2] minim.[3] infant.[4] lacten.[5] detur, secundis horis; phiala agitata.

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[1] Julepum. [2] Cochleare. [3] Minimum. [4] Infantulo. [5] Lactenti.

12. ℞ Sp. Ammon. Arom., f ʒ i ;
Tinct. Asafœt., f ℥ ss ;
Syrupi, f ʒ iii ;
Aq. Cinnam., f ℥ i.

M.—Exhibe cochl. parv. ter quaterve de die, vel sæpius, urgente convuls.[1] vel spasm.[2]

13. ℞ Tinct. Hyoscyami, f ʒ iss ;
Pot. Acet., ʒ iv ;
Syr., fʒii ;
Aq. Menth. Vir., ad f ℥ vi.

Ft. mist. cujus sumant.[3] cochl.[4] ii vel iii minim.[5] bis terve in die, vel ut opus sit.

14. ℞ Tinct. Opii, f ʒ ss ;
Mist. Cret., f ℥ iii.

M.—Cap. cochl. ii magn.[6] omni quadrante horæ, donec leniat.[7] dolor.

15. ℞ Pulv. Ipecac., ʒ iss ;
Pot. Bitart., ʒ i ;
Aq. fervent., f ℥ iiiss.
Macera per horam integr.[8] dein cola et adjice syr., f ℥ ss.

M.—Detur ℥ ss vel cochl.[9] ampl.[10] omni semihorâ, donec vomit.[11] proritav.[12]

16. ℞ Plumbi Acet., gr. iv ;
Syrup., f ʒ ii ;
Aq. Menth., f ℥ ii.

M.—Cap. cochl. ampl.[13] mane quotidie ; repetat.[14] dosis ad iii vices, et deinde cap.[15] æger haust[16] aliq.[17] purgant.[18]

17. ℞ Mist. Ammon.,[19] f ℥ vi ;
Cap. æger cochl. mag. bis in die ex poculo jusc.[20] bov.[21]

18. ℞ Morph. Acet., gr. ¼ ;
P. Colch.,[22] gr. iii.
Ft. pil. 4tis[23] horis s.[24]
Mitte vi fol.[25] arg.[26] inv.[27]

19. ℞ Sodii Bicarb., ʒ iii ;
Ammon. Bicarb., ℈ii ;
Pot. Nit., ʒ ss ;
Syr. Aurant., f ℥ ss ;
Ac. Hydrocyan. dil., gtt. xx ;
Aquæ, ad ℥ viii.

M.—Capiat ℥ iss t. in d. cum pulv. i seq.[28] m.[29] stat.[30] effervesce.[31]

20. ℞ Ac. Tart., ℈i ;
Mitte chart. vi.

21. ℞ Ol. Morrhuæ, f ℥ viii.

Sum.[32] coch. min. (ad. ampl.[33] augend.[34]) bis die c.[35] mist. sequent.[36] coch. ampl.[37]

22. ℞ Acid. Phosph. dil., f ℥ ss ;
Tinct. Nuc. Vom., f ʒ ii ;
Tinct. Calumb.,
Syr. Zingib., āā f ℥ i ;
Aq. Cinnam., q. s. ut ft. f ℥ viii.
M.—Ft. mist.

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[1] Convulsione. [2] Spasmo. [3] Sumantur. [4] Cochlearia. [5] Minima. [6] Magna. [7] Leniatur. [8] Integram. [9] Cochleare. [10] Amplum. [11] Vomitum. [12] Proritaverit. [13] Amplum. [14] Repetatur. [15] Capiat. [16] Haustum. [17] Aliquem. [18] Purgantem. [19] Ammoniaci. [20] Jusculi. [21] Bovini. [22] Colchici. [23] Quartis. [24] Sumenda. [25] Folio. [26] Argenteo. [27] Involve. [28] Sequenti. [29] Mane. [30] Statu. [31] Effervescentiæ. [32] Sumatur. [33] Amplum. [34] Augendum. [35] Cum. [36] Sequentis. [37] Amplo.

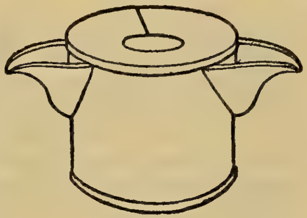
METRIC PRESCRIPTIONS

The growth of the metric system has made it necessary for every pharmacist to be acquainted with the methods employed in writing metric prescriptions.

There are two distinct methods employed in this country, which may be termed respectively the *gravimetric* and the *volumetric* method.

1. **Gravimetric Prescriptions.**—The gravimetric principle of weighing liquids is used in Germany and some other Continental countries almost exclusively. It was adopted by the U. S. Pharmacopœia of 1880, and given the name of "parts by weight;" but, although weighing liquids may be practised with advantage in the laboratory in making large quantities of preparations, and is preferable in the case of thick or adhesive liquids, it is far less convenient in compounding prescriptions than the plan of measuring the liquid ingredients. The advantage in supposed greater accuracy of weighing over measuring is more imaginary than real. A careful pharmacist will compound prescriptions just as accurately by measuring the liquids as he will by weighing them, while a slovenly one will be just as careless in using weights as he is in measuring liquids. The question of accuracy becomes then, practically, a "personal equation."

Fig. 607



Tare can

Several conveniences have been proposed in weighing liquids, which deserve notice. The Germans use a "tare can" (see Fig. 607) for the purpose of quickly taring a bottle. It is a small metallic can having a shallow funnel mouthed opening, with two spouts, one on each side. The bottle, or vessel, is placed on one of the scale pans, and the tare can, containing sufficient shot or clean dry sand to balance it, is placed upon the other. It is better, however, to use two tare cans and pour from one to the other, the one not in use on the scale pan either receiving the excess of shot or supplying the deficiency.

2. **Volumetric Prescriptions.**—In these the gramme is replaced by the mil or cubic centimeter, which was very appropriately termed *fluidgramme* by Mr. A. B. Taylor. The principal reason for preferring the volumetric method is that the physician has the means of more readily calculating and apportioning the number of doses in the prescription. *Liquid medicines are never administered by weight*, but always by teaspoonfuls, tablespoonfuls, or other convenient measure. In some liquids there is a wide difference between their weight and their volume, as the specific gravity tables abundantly show. A teaspoonful of ether weighs forty-one grains, while a teaspoonful of chloroform weighs eighty-five grains (more than twice as much). Hence the physician cannot disregard specific gravity. In prescribing gravimetrically and administering volumetrically he must constantly bear in mind these differences, at least approximately. Mistakes are very likely to arise in making these calculations, mentally, at the bedside of a patient. Hence it is far better to avoid

them by *prescribing the medicines by the same method as that by which they are dispensed and administered, namely, volumetrically*, and thus preserving that harmony of relation which is conducive to safety. If volumetric analysis is preferred to stathmetic or gravimetric analysis in the U. S. Pharmacopœia because of its greater convenience and at least equal accuracy, why should not liquids be measured rather than weighed in pharmaceutical operations in which extreme accuracy is comparatively of less importance?

The following examples illustrate the forms of metric prescriptions most frequently used. Form A is preferable, for the reasons stated :

Form A	**Form B**	**Form C**
℞ (*Volumetric*) Gm. and mils Quininæ Sulph . . . 1 │ Strych. Sulph . . . │ 016 Fluidext. Glycyr. . 4 │ Syrupi . . . . 60 │ A teaspoonful three times a day.	℞ (*Gravimetric*) Quininæ Sulph. . . . 1. Strych. Sulph. . . . .016 Fluidext. Glycyr. . . 4. Syrupi . . . . 60. A teaspoonful three times a day.	℞ (*Volumetric*) Quininæ Sulph. 1. Gm. Strych. Sulph. . .016 Gm. Fluidext. Glycyr. 4. mils Syrupi . . . . . 60. mils A teaspoonful three times a day.
℞ (*Gravimetric*) Hydrarg. Chlor. Mit. │ 5 Aloe. Pulv. . . . . . 2 │ Rhei Pulv. . . . . . 1 │ 5 Make twenty pills.	℞ (*Gravimetric*) Hydrarg. Chlor. Mit. .5 Aloe. Pulv. . . . . . . 2. Rhei Pulv. . . . . . . 1.5 Make twenty pills.	℞ (*Gravimetric*) Hydrarg. Chlor. Mit. .5 Gm. Aloe. Pulv. . . . . 2. Gm. Rhei Pulv. . . . . 1.5 Gm. Make twenty pills.
The advantages of the decimal line are that the decimal dot is abolished, with its dangerous complications, for a spot or a fly speck on the prescription paper may increase or decrease the quantity of an ingredient *ten times*, and the use of the decimal line is familiar to all who use a dollar and cents column.	This form is used frequently, because of the familiarity with the arithmetical method of using a dot to denote a decimal fraction; and where metric prescriptions are altogether in use, as in Continental Europe, there is no necessity for indicating the denomination, gramme being always understood.	This form is an improvement on Form B, and would be far superior to it for use in this country, where prescriptions written in the old systems will long continue to be used; for next to writing out in full the word *gramme*, the indication of the unusual quantity by underscoring will prevent its being mistaken for *grain*.

THE ART OF COMPOUNDING AND DISPENSING

The practical work embraced in the ever varying labors of compounding and dispensing constitutes a more searching test of the adaptability and qualifications of the pharmacist than any other duty that he is called upon to perform. Careful training, tact, and much experience are needed to meet the requirements.

Receiving the Prescription or Order.—This apparently simple matter, if not carefully considered, is frequently the source of embarrassing mistakes. Very few customers, even if they are intelligent, realize the necessity of forethought or care in calling for any articles that they wish. Hence it is an excellent practice for the dispenser to *repeat the order* interrogatively at the time that it is given, and obtain from the customer a clearly expressed assent before delivering the article, lest the wrong one be dispensed. If it is a poisonous substance, the use that is to be made of it should be carefully inquired into, and in all cases a written order, properly dated and signed, should be required. The best plan is to have a regular poison book, in which the record is made. Poisonous or dangerous substances should never be dispensed to children or minors without a written order, and even then the receiver should be cautioned about the contents.

The following prescription memorandum, which is similar to one suggested by Andrew Blair, was in use several years by the author with excellent results. These blanks are put up in tablet form, and are filled in, in the presence of the customer, or the back of the prescription may be used for noting the points when it is handed in.

MEMORANDUM

Name.
Address.
Is it paid for?
Is it to be charged?
Is it to be called for?
Is it to be sent?
Received by
Compounded by
Number of ℞ and Price.

It is the custom in some pharmacies, when a number of prescriptions are being compounded at one time, to use what is known as the check system. Brass or nickel plated checks or disks, numbered or lettered, are used. The customer upon handing the prescription is given a check, which he holds until the prescription is ready; the receiver marks the corresponding number or letter upon the prescription, and when he delivers the bottle or package receives back from the customer the original check containing the same number or letter. This system is not without faults; indeed, unceasing vigilance is absolutely necessary, and it is not safe to place faith in any system.

The prescription should be received with becoming dignity by the compounder, and questions answered with cheerful politeness, especial care being taken to do or say nothing that would impair confidence. Unseemly jesting, loud conversation, or boisterous mirth is entirely out of place here, while especial regard should be paid to the feelings of those who may have just left the sick chamber or the bed side of one who is dear to them. In such cases every word and movement of the dispenser is often carefully watched, and, while ordinarily the customer may be disposed to judge seeming slowness or indifference leniently, at such times these faults become unbearable to the impatient and anxious messenger.

Reading the Prescription.—The prescription should be read over carefully, and judgment mentally pronounced, first upon the safety of the doses of the respective ingredients, and then upon their compatibility. If this reading be done in the presence of the patient, especial care should be taken that the countenance reveal nothing whatever of what may be going on in the mind of the receiver. A shrug of the shoulders, an elevation of the eyebrows, a contemptuous toss of the scrap of paper on the prescription desk, may convey to the mind of the patient a more lasting impression of the opinion of the receiver as to the merits of the prescription than open criticism. Questions are frequently asked by patients and requests made for opinions. These should always be skilfully parried. An apothecary has no right to reveal to a patient the character or the medicinal effect of the ingredients which enter into a prescription. When the names of the ingredients in the prescription are persistently demanded by the patient, the dispenser can fall back upon the expedient of frankly stating that it is a breach of etiquette to reveal the character of the ingredients, and intimating that it shows a lack of confidence in the prescriber on the part of the patient; but, if further insisted upon, the offer to send to the physician a written request to get his permission to disclose the ingredients is generally answered by the patient with a gracious "no matter." The pharmacist, as a coworker with the physician in the healing art, is ethically bound to sustain him and cheerfully cooperate with him, and there should be at all times a spirit of mutual respect between the members of both professions, and a feeling that each is in duty bound to protect the other from unjust censure.

In order to gain time in case of doubtful procedure, it is often good practice to write the label for the prescription as soon as it is received, and this will usually afford an opportunity to study the prescription while reading it. The only objection to this is that the patient very frequently misunderstands this manœuvre, and imagines that the dispenser is neglecting him and not proceeding at once to compound his prescription.

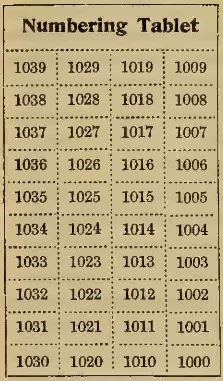
Compounding the Prescription.—The greater part of the succeeding chapter will be devoted to the details of this very important duty; in this place it is merely necessary to consider the general features. After thoroughly understanding the prescription and clearly deciphering it, a method must be quickly formulated for compounding it. In this connection, if there is any doubt about safety, the well known aphorism, "When you do not know what to do, do nothing," has great force. The work of compounding must not go on in any feeling of uncertainty; the chance of causing death or serious consequences is too great to warrant the running of risks, and there is nearly always more safety in delay than in pushing forward doubtfully.

When a clearly outlined plan of procedure is decided upon, the ingredients should be carefully weighed or measured and the process witnessed by a colleague. *The system of double checking prescriptions should be invariably followed wherever possible;* over confidence and an indisposition to recognize the possibility of making a mistake have probably occasioned more loss of life in this responsible work than any other cause. Not only should the junior assistant cheerfully submit to having his work witnessed, but even the *preceptor* should insist upon one of his assistants checking off the ingredients and quantities which he has weighed or measured out himself, as a matter of principle and method. If this is not always possible, on account of there being but one present in the store, the system of single checking should be invariably practised. This is, briefly, to arrange upon the counter the shop bottles or packages from which were taken the ingredients which entered into the prescription, and place the weights which were used immediately in front, then, when the preparation is finished, to check off from the prescription each ingredient in order, noting the weight or measure. Before permitting a prescription which is at all complicated to advance further in the process of compounding, each ingredient should be numbered in lead pencil on the margin in the order in which it has been added. This memorandum becomes valuable when the prescription is to be renewed, because there will then be no likelihood of the renewed prescription differing from the original.

Additions or Alterations to Prescriptions by the Pharmacist.—At the present time it is the custom among physicians to hold the pharmacist responsible for the proper compounding of prescriptions intrusted to his care, and to depend upon him. Such details as the choice of the excipient, method of straining or filtering, etc., are usually not specified. Indeed, with many it is a frequent practice simply to direct a solution or mixture of definite strength and rely upon the pharmacist to make it palatable. In all cases of this kind, care must be taken to make a note upon the prescription of each addition, so that in the event of renewal there may be no difference between the preparation then obtained and the original. The confidence which physicians place in pharmacists in this respect should be most sedulously guarded and every effort made to deserve and retain it. This can be done only by adhering strictly to the rule of *not permitting an alteration or addition to be made to a prescription which would affect or vitiate its proper medicinal action or interfere with the obvious intention of the prescriber.*

Numbering the Prescription.—It is the universal practice to number the prescription, and to place a corresponding number upon the label, the object being to identify the bottle or package in case of renewal and connect it with the original prescription. This apparently simple matter requires upon the part of the compounder concentration of thought to avoid errors,—one of the most frequent lapses being that of duplicating the number of the last prescription, instead of numbering it consecutively. This, in case of renewal, may lead to serious consequences, particularly if one prescription happens to be a four ounce aconite liniment and the other a four ounce solution of similar appearance for internal use. The duplication of the numbers is particularly liable to occur when several prescriptions are being compounded at the same time by two or more assistants. Various expedients have been proposed to obviate mistakes of duplication. One is to have a strip of paper about an inch wide numbered consecutively, rolled with the highest number inside, and placed in a round tin ointment box which has a slit in the side to permit the end of the strip to appear; this may be hung in a convenient place and the number cut off and pasted on the prescription, or, if the location is one having a dry atmosphere, a gummed strip may be used. Another method is to arrange the numbers upon gummed sheets and bind them in book form, or glue the edges and use as tablets (see Fig. 608); in the latter case the numbers are printed in perpendicular columns, and the margins are perforated so that the outer strip from 1000 to 1009 may be torn nearly off, and each number then cut off with scissors or gently torn off as it is wanted.

Fig. 608



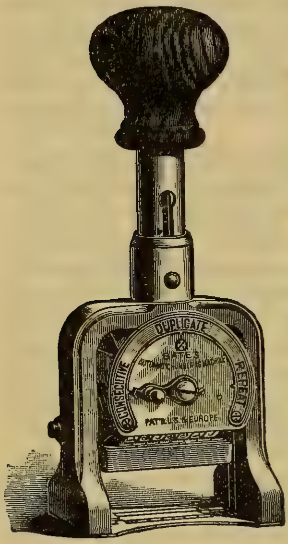
Numbering Tablet			
1039	1029	1019	1009
1038	1028	1018	1008
1037	1027	1017	1007
1036	1026	1016	1006
1035	1025	1015	1005
1034	1024	1014	1004
1033	1023	1013	1003
1032	1022	1012	1002
1031	1021	1011	1001
1030	1020	1010	1000

Numbering tablet

Consecutive numbering machines are also used; these are very convenient, and serve excellent purposes if they are properly and durably constructed. The best machine known to the author until recently was made in Vienna, and can be adjusted to number *automatically* either consecutively, repeatedly, in duplicate or in triplicate.

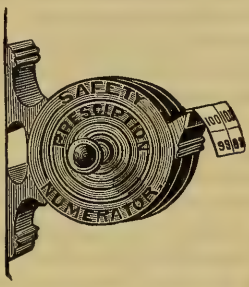
The usefulness of this machine to the pharmacist consists largely in the fact that it can be made to *number consecutively in duplicate* (13428, 13428; 13429, 13429, etc.), so that if a proper sized machine is chosen (letter *b* is preferred) the number may be clearly and neatly printed upon *both prescription and label;* the machine may then be locked and set, so that there is not the slightest danger of variation or change in the method of numbering while in use. The Bates automatic numbering machine (see Fig. 609) is the best of those made in America, and, in some respects, it is better than the one just described. It can be set so that the numbers will be consecutive, repeated indefinitely, or repeated in duplicate. The value of using a mechanical contrivance of this kind consists in its numbering in duplicate with absolute freedom from mistakes, and in the entire elimination of chances of error from defective handwriting, the figures being printed from hardened steel disks, invariably producing clear and distinct impressions.

Fig. 609



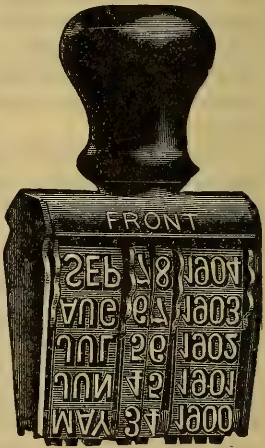
Numbering machine

Fig. 610



Safety prescription numerator

Fig. 611



Rubber dating machine

Fig. 610 shows a very simple and practical apparatus for numbering prescriptions and checking mistakes in numbering. It may be obtained from E. T. Ellis, Philadelphia, and consists of a rolled strip of paper (gummed or ungummed), fastened at one end upon an axis which is free to revolve in a cylindrical box. A double row of consecutive numbers is printed on the strip, and a slit in the edge of the box permits the unrolling of the strip over a knife edge fastened on the outside.

Rubber numbering stamps are also in use; these are much cheaper and smaller than the consecutive numbering machines, and are very convenient. They are not automatic, however, and mistakes are liable to occur through the operator forgetting occasionally to turn one of the bands, and thus the main reason for using a numbering machine is lost. The numbers are cast upon endless rubber strips, and resemble the daters (see Fig. 611).

Dating.—This also serves to fix the identity of a prescription, and it should never be omitted. The physician usually appends the date, but the prescription is frequently held by the patient and not presented for compounding upon the day on which it is written. As in the case of numbering, the date is most frequently written upon the face of the prescription by the pharmacist; and this should not be omitted, even though the date written by the physician be visible. The habit of dating should be firmly established, because it may prove of vital importance in case of a subsequent discussion or difference of opinion. *Rubber daters* are largely used now. Fig. 611 shows one which may be obtained at any stationers. It is inexpensive, not liable to get out of order, and so convenient for prescription work that it soon pays for itself.

Pricing.—The price of the prescription must always be marked upon it. This is necessary in order to fix the sum in case of renewal. The price is usually not subject to variation, except in the case of a patient ordering a larger or smaller quantity of the prescription. In renewals, in all cases the increase or decrease should be noted distinctly, if future annoyance is to be avoided. Few occurrences are apt to create more distrust in the mind of the patient than a neglect of this precaution, the reasoning being that if the pharmacist is so careless as to have two prices for the same prescription, he probably has been careless in compounding it. The greatest objection arises, however, when the price asked is *greater* than that originally demanded.

It is usual for the pharmacist to adopt a cipher to show the price of the prescription, some word or combination of characters being selected and memorized. If a word is selected, it should have ten letters, and there should be no duplicate letters, thus:

COME AND BUY
1234 567 890
C.YY—$1.00; OA—25 cents, etc.

The following words or phrases may be used as price marks: Behaviour, chemistry, complaints, no mistake, volumetric, duplicates, republican, democrats, epistolary. A word with nine letters requires an odd letter, usually X. Sometimes a repeater, like X, is employed; thus, in "come and buy," $1.00 would be C.YX. The cipher adopted by the National Association of Retail Druggists is largely used. It is PHARMOCIST (see page 1649).

It frequently happens that physicians desire to indicate that a patient is poor and is a proper subject for charity. This is usually done by writing the letter P in the lower corner, or, if very poor, PP.

Investigations into the prices received for prescriptions in the average drug store have clearly shown the need for the adoption of scientific business methods in deciding upon the price to be charged. Where the old-fashioned method has been followed of having a flat price for a two-ounce mixture, a fixed amount for a dozen pills, etc., it has been shown that often a prescription is dispensed at an actual loss and the department frequently run without any profit. This policy is often indirectly responsible for failure to establish a successful prescription pharmacy. The fundamental principles of business demand that to be successful the price charged must be sufficient to insure the use of the best ingredients and containers, the employment of skilled assistants, the payment of all other costs and expenses and the final making of a profit.

Many pharmacists have found that the adoption of such a policy has given them the opportunity to impress the physicians and the public by the quality of their service and to increase their business instead of reducing it.

But how shall this selling price be determined so that it is sufficient and yet not excessive? It involves, first, the exact cost of ingredients used in the prescription; secondly, the approximate cost of containers, labels, wrapping paper, etc.; thirdly, the labor and overhead cost, and, lastly, the desired profit.

The first of these factors is constantly changing and requires that the pharmacist frequently consult up-to-date price lists. Do not guess at prices, but know the current market value, especially of drugs and chemicals. As ingredients are usually bought in comparatively large quantities, and as there is a large percentage of waste and also loss from deterioration, it is customary to double the cost of materials in calculating the price of a prescription.

The cost of containers should also be known exactly and this with the cost of labels, paper, etc., should next be added to the price.

The actual time spent in compounding the prescription represents a definite cost and each prescription should carry its share of the general overhead expenses, such as rent, light, heat, insurance, etc., which make it possible to open the prescription department. Usually this is estimated, and the calculation for each prescription is based upon the time required, at a fixed rate per hour, say $1.00 or $1.50.

When the actual costs have been determined, the amount to be charged for profit may be given consideration. Sometimes this is included in the amount added for time consumed and that is the simplest plan; again it may be a definite addition to the actual cost, say of 10 to 20 per cent.

A plan for prescription pricing which has proved very satisfactory, and has received the approval of the American Pharmaceutical Association, is known as the *Evans' rule.* It is as follows: "Add a profit of 100 per cent. to the actual cost of ingredients and container and then charge at the rate of $1.00 per hour for the actual time consumed in compounding."

Pharmacists will discover in using any rules that sometimes the price seems to be excessive, again not high enough, and this must be expected since no one plan will meet the needs of every community; but the principles outlined are universally operative and are worthy of serious consideration, for the cost must first be covered and then the amount of actual net profit to be secured may be determined by the conditions.

The National Association of Retail Druggists has outlined a prescription pricing schedule which has been extensively adopted; it is as follows:

N.A.R.D. PRESCRIPTION PRICING SCHEDULE

(All figures are compounding fees only)

HOW TO FIX PRICE. THIS IS IMPORTANT:—

The price of the prescription is the compounding fee, + the cost of the container + twice the cost of the material. (Exception: When the cost of material is over $1.00, multiply cost by 1½ instead of 2; and further, if the cost is over 50c. and under $1.00, adopt the following sliding scale: Cost 60c, add $1.10; cost 70c, add $1.20; cost 80c, add $1.30; cost 90c, add $1.40. These prices are based on a $1.50 per hour scale.

EXAMPLE—If the ingredients of a four-ounce mixture cost 12c, compute price as follows: Compounding fee, 35c, + container, 5c, + twice cost of material, 25c (12 × 2) = total, 65c.

1.—LIQUID PRESCRIPTIONS: Minimum total charge, 25c. All simple or compound mixtures, internal or external, dry or liquids and veterinary preparations are included in this table. Eye remedies, sprays for nose and throat, injections, etc., should be charged for as in the column. "Dose ʒii–ʒi."

Quantity	Dose. 1–5 M.	Dose. 10–25 M.	Dose. ʒss–ʒi	Dose. ʒii–ʒi	Gargles and Liniments only
½ oz.	.25	.20	.15	.10	.10
1 oz.	.35	.30	.20	.15	.10
2 oz.	.45	.35	.25	.20	.15
3 oz.	...	.40	.30	.25	.20
4 oz.	...	...	.35	.30	.25
6 oz.	...	...	.40	.35	.30
8 oz.	...	...	.45	.40	.35
12 oz.	...	...	.55	.45	.40
16 oz.	...	...	.60	.55	.50
32 oz.	...	...	.75	.70	.65

2.—PROPRIETARIES: Original package, regular retail price; when costing over $2, $4 or $8 per dozen, add 65 per cent. to cost; when transferred to new container, add 15 per cent. to regular retail price. When part of package is dispensed, double cost of amount used, add charge for container and one-half of the compounding fee (see above).

3.—DRY MIXTURES: Minimum total charge, 15c. These figures are compounding fees only.

Pills, Powders, Capsules, Wafers, Etc.

Number	4	6	8	10	12	15	20	24	30	40	50
Fee	15c	20c	25c	30c	35c	40c	45c	50c	60c	75c	90c

Then every additional 25 up to one hundred, 25c. After that 20c for every additional 25.

Where powders are prescribed by the ounce, charge as follows for compounding fee: 1 oz., 25c; 2 oz., 35c; 3 oz., 40c; 4 oz., 45c; 6 oz., 50c; 8 oz., 55c; 12 oz., 65c; 16 oz., 75c, etc.

Proprietaries costing 20c per hundred or less, 10c for labelling and package, and 15c for 1 doz., 25c for 2 doz., 35c for 3 doz., 40c for 4 doz., then 5c for each additional dozen. Costing over 20c and under 50c per hundred, 10c for labelling and package, and 20c for 1 doz., 35c for 2 doz., 50c for 3 doz., 60c for 4 doz., then 10c for each additional dozen. When the wholesale price is over 50c per hundred, special rates may be made.

4.—FATTY MIXTURES, ETC.

Ointments and Cerates.

½ oz	.20	2 oz	.35	4 oz	.55	8 oz	.75
1 oz	.25	3 oz	.45	6 oz	.65	16 oz	1.00

Suppositories, Bougies, Etc.

1	.20	5	.45	12	.75	24	1.35
2	.30	6	.50	15	.90	30	1.60
3	.35	8	.60	18	1.05	36	1.80
4	.40	10	.65	21	1.20		

5.—VETERINARY: Allow a discount of 25 per cent. from the regular schedule on compounding fee only, except that for bulk powders the minimum charge be 25c for compounding.

6.—HOUSEHOLD REMEDIES, MIXTURES, ETC.: Add regular retail price of ingredients (none less than 5c) and charge for container. If any compounding is necessary, charge at rate of $1.50 per hour.

7.—CONTAINERS: Pill and Powder Boxes, 5c; Ointment Boxes, 5c; Ointment Jars, 1 oz., 5c; 2–4 oz., 10c; 8 oz., 15c. Bottles, 8 oz. or less, 5c; 10–16 oz., 10c; 32 oz., 15c; ½ gal., 20c; 1 gal., 25c. Glass Stoppered Bottles, three times the price of plain bottles.

8.—MARKING PRICE ON PRESCRIPTIONS: If a prescription or copy leaves your store, mark it with N. A. R. D. price, as follows:

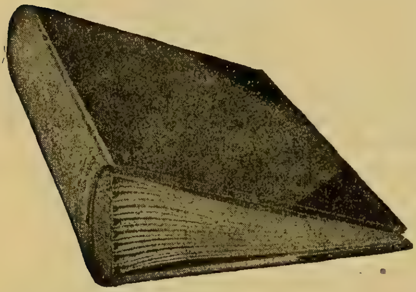
P	H	A	R	M	O	C	I	S	T
1	2	3	4	5	6	7	8	9	0

9.—ADMISSIBLE CHANGES: If customer is poor, add a star (*) to price mark, showing you have gone below Schedule Price. If your present prices are lower than above, raise them gradually to Schedule Prices.

Filing, Binding, and Preserving.—There is very little uniformity of practice among pharmacists in the particulars of filing, binding, and preserving prescriptions. The usual practice is one which is most inconvenient,—*i.e.*, that of simply filing them away upon a long brass wire yearly, half yearly, or quarterly. By this plan they are sure to become in time torn, dirty, dusty, and fly-specked, and the file is very unsightly. The method of pasting them daily into a large invoice book is an improvement. The objection to this plan is, however, that the backs of the prescriptions cannot be examined readily, and in an active business the unwieldy books soon accumulate so as to be an inconvenience.

Post binders, such as are used for ledgers, are now available at reasonable prices and may readily be adapted to the filing of prescriptions. Small binders can be fitted with punched stubs to which the prescription is attached by pasting on the edge, or the larger binders may be used and the prescriptions pasted upon the punched manila pages. As the binder is filled the pages are removed and placed in suitable transfer binders or cases. *Mann's binder* is somewhat similar to the modern post binder and has been used for the filing of prescriptions.

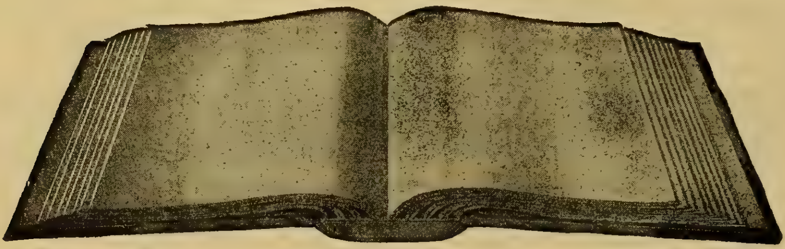
Fig. 612



Empire prescription book

Many pharmacists copy their prescriptions into a book kept for the purpose. This plan is not always a judicious one. The chances of making errors are increased, and, in case of dispute, proof of the correctness of the copy would have to be produced. Others paste the prescriptions into a book. This is a better plan, but open to the objection that memorandums, addresses, etc., which are often written on the back, are rendered useless, unless the prescriptions are pasted only on the edge.

Fig. 613

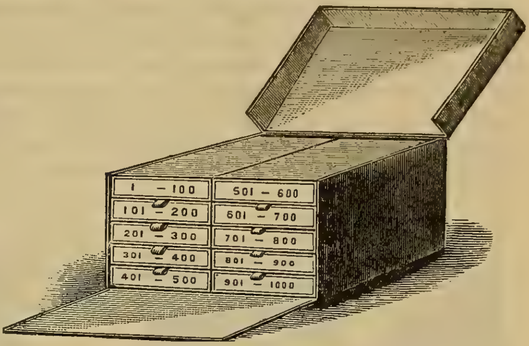


Empire prescription book (open)

Fig. 612 shows the *Empire prescription book* made by Fox, Fultz & Co., of New York and Boston. It opens easily and lies flat upon the counter. The sections of leaves are securely held by copper rivets through the wooden back. Fig. 613 illustrates the open book and method of binding.

Fig. 614 shows a box for holding cases containing numbered prescriptions made by J. F. Lawrence, of Chicago. The cases are numbered on the edge so that their contents can be easily referred to.

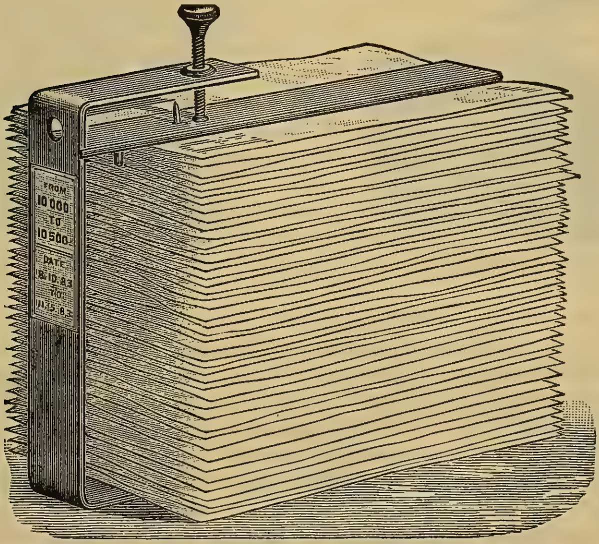
Fig. 614



Lawrence's prescription box

Fig. 615 represents a prescription file devised by R. H. T. Nesbitt, of Leavenworth, Kansas. The presciptions are retained in place by the movable flat iron bar which is represented upon the top of the file. A pointed wire passes upward from the bottom of the frame, and the prescriptions are filed upon it in the ordinary way; the movable iron bar may be screwed down upon the pile, and they are thus kept in place. When a prescription is to be renewed and access to one of those in the pile is desired, the bar is raised by means of the screw, and the prescription turned sideways and read. The hole seen in the frame near the top of the side is for hanging the file on a nail.

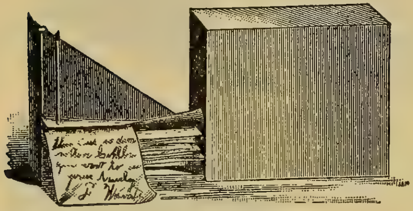
Fig. 615



Nesbitt's prescription file

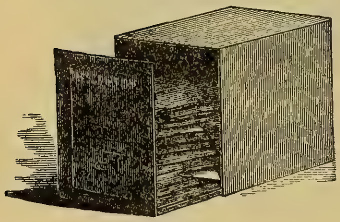
Anderson's prescription file, box file, and cabinet are shown in Figs. 616, 617, and 618. The object of this invention is to provide a means for collecting, protecting, and preserving prescriptions. In Fig. 616 the file holder is shown; this is intended to serve for the collection of the prescriptions as they are received. It is represented as partly filled with prescriptions. The bottom of the slide is of wood and is securely fastened to the tin front and side. In the corner is placed a hollow pin, on which the prescriptions are filed. Each file is supplied with ten index cards, numbered from "100" to "1000." These cards are intended to be placed between each hundred prescriptions, to facilitate the finding of a prescription when it is to be refilled. If it should be desirable to remove a prescription from the file, it may be readily done by inserting the transfer wire into the hollow pin and removing on the wire all prescriptions from above the one desired, which can then be removed by itself. When a prescription is to be renewed, it is turned to the left, as shown in the illustration, thus exposing it thoroughly for reading. The case is preferably made of tin in order to protect the prescriptions from dust, moisture, mice, and insects.

Fig. 616



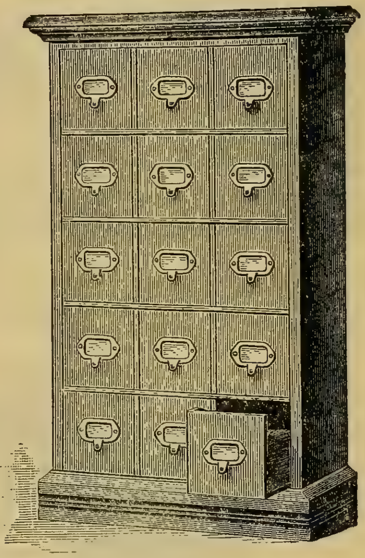
Anderson's file holder

Fig. 617



Anderson's box file

Fig. 618



Anderson's filing cabinet

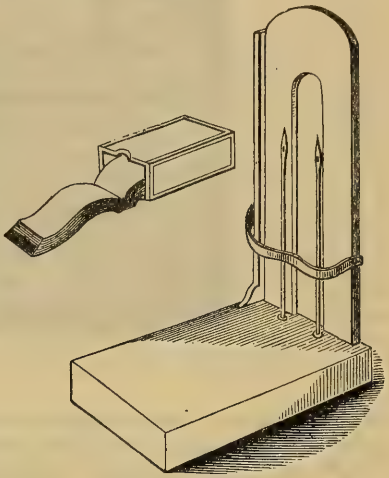
Fig. 617 represents a front and side view of the file. A punch is used to cut a clean, round hole in each prescription. A perforation without ragged edges constitutes one of the most important details in filing prescriptions, for it permits the prescriptions to lie flat upon each other, thus taking up less room, and the prescriptions are not likely to be mutilated if they are free to slip easily around the filing wire. A place is provided upon the top of the cover for the punch, so that it may always be kept within reach.

Fig. 618 shows a cabinet which is designed to permanently store the prescriptions after the box files are full. Upon the front of each box file there are two depressions, intended to hold blank cards to be used for the numbers of the first and last prescription.

The cabinet will accommodate fifteen box files, and as each file is capable of holding 1000 prescriptions, it will be seen that the capacity of the cabinet is 15,000 prescriptions. The drawers are of wood, and are of the same design as the slide in the single file.

Naulty's prescription file is shown in Fig. 619. The prescriptions are held securely upon two needles in such a position that for reference they can be found quickly and an unobstructed view obtained while compounding, the band shown in the cut being used for holding the succeeding prescriptions up. When a month's prescriptions, or any desirable number, have been filed, the needles are threaded with strong twine, and the pile pulled carefully off, the twine passing through the holes; the ends of the twine are now secured and a piece of thick muslin glued upon the back, and the back dated and numbered. The books are then placed in boxes, which are likewise numbered and dated distinctly. The cut also illustrates the method of keeping the bound book open while compounding a prescription.

Fig. 619



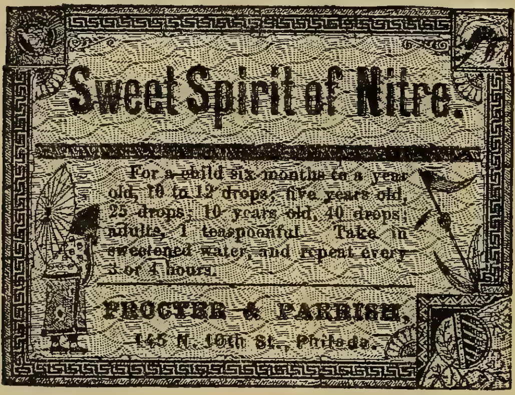
Naulty's prescription file

Card Index Prescription File.—The card index system, so valuable for many purposes, is used for prescriptions, but it is not as generally satisfactory as the Anderson file, which permits reference to the *original prescriptions,* which are easily and quickly consulted.

LABELS

It should be an invariable rule, in dispensing, that *every medicinal substance* sent out from the store *must have* a neat and distinct label upon it. It is necessary to establish this rule as a fixed custom or habit, for neglect of this precaution will often result in serious consequences. In addition, every package *should be labelled at once,* particularly in the case of prescriptions. The habit of permitting unlabelled packages to remain about, liable to substitution, will inevitably cause doubt, and give rise to some grave mistake, sooner or later. A very great diversity of opinion and taste is apt to prevail with regard to the most suitable style of label to select for general use. Formerly the home printer was exclusively depended upon, but the principle of division of labor has led to the establishment of "druggists' printing houses" in several sections of the country; this has resulted in cheapening labels, and the labor seems to have been largely expended in this direction, and toward elaborating gaudy designs, very few attempts having been made as yet toward attaining that simplicity and elegance in design which the principles of good taste clearly dictate. Lithographed labels are sought for principally because the designs more closely approach those of engraved labels; but engraved labels cannot be used generally, because of their costliness.

Fig. 620



Sweet Spirit of Nitre.

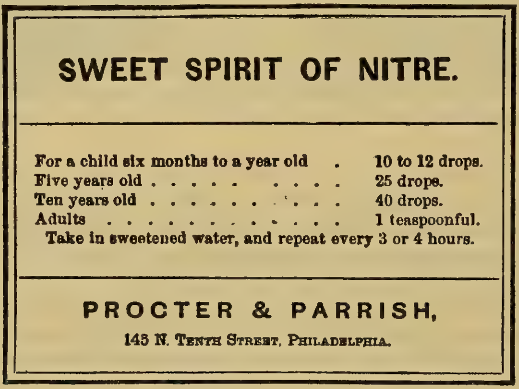
For a child six months to a year old, 10 to 12 drops; five years old, 25 drops; 10 years old, 40 drops; adults, 1 teaspoonful. Take in sweetened water, and repeat every 3 or 4 hours.

PROCTER & PARRISH,
145 N. 10th St., Phila'da.

Fancy, obscure, and pretentious label

Bronze, green, and red bordered labels are seen in label catalogues in great profusion, and in one a sentimental moonlight Venetian scene in colors is conspicuously displayed on one end of a castor oil label! One leading principle will probably be of service in this connection, and that is to avoid loud, striking designs of all kinds. The appetite of all, patient, pharmacist, and physician, soon becomes satiated with such, and the notion that they influence business in any good way is soon proved to be a delusion. The almost universal

Fig. 621



SWEET SPIRIT OF NITRE.

For a child six months to a year old . 10 to 12 drops.
Five years old . . . . 25 drops.
Ten years old . . . . 40 drops.
Adults . . . . 1 teaspoonful.
Take in sweetened water, and repeat every 3 or 4 hours.

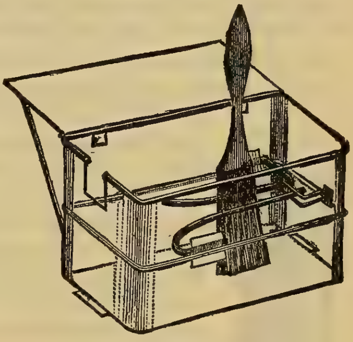
PROCTER & PARRISH,
145 N. Tenth Street, Philadelphia.

Plain, old fashioned, and inexpensive label tendency of printers in selecting type for a label is to choose the largest that can possibly be used to get the subject matter inside the border. The effect is exactly opposite to that which is usually desired, for it adds nothing to the neatness of the label, certainly sacrifices distinctness, and the general impression conveyed is that of a confused mass of letters, which is more difficult to decipher than letters of the proper size and breadth of face appropriately set off by *sufficient blank space.* Plain black letters on a white ground are preferable. (See Figs. 620 and 621.)

Neatness, distinctness, and simplicity are cardinal principles in designing labels, and the reputation of many establishments is frequently judged from the character of the outward signs of neatness and care. For this reason particular attention should be paid to prescription labels, not only to have the printed address plain, clear, and neat, but to have the handwriting to correspond. In these important particulars patients are exceedingly apt to form an estimate of the qualifications of the compounder of a prescription from the style of his penmanship, reasoning that if he is careful, clean, and neat in the *one particular* of which they are competent to judge,—*i.e.*, the handwriting on the label,—the compounder must exercise similar qualifications in the more vital operations involved in compounding and dispensing, for upon the technicalities of the latter they cannot hope to pass judgment.

Labelling Poisonous Substances.—Whenever a poison is dispensed to customers upon an order, without being prescribed by a physician, the word poison should be distinctly written upon the label. If solid, and wrapped in paper, it should have two wrappers upon it, and both should be labelled poison. In the case of prescriptions, the word poison *should not appear upon the package or bottle unless the physician has so directed.* A careful pharmacist will be sorely tempted to prevent possible accident by pasting a poison label upon the package, but he is relieved entirely of responsibility if the dose is not excessive and if the physician has not directed it, because there is usually a special reason *for omitting it* from the label,—namely, that of avoiding the possibility of frightening the patient and thus defeating the object of the prescription. When a poison label is to be used upon a bottle it should be pasted on above the prescription label, so that it will be more likely to be seen, without possibility of failure through being covered by the hand holding the bottle.

Fig. 622



Sabin's mucilage can

Pasting Labels.—Few of the minor operations in dispensing are more important than this. Although frequently the subject of remark and criticism, there have been comparatively few real improvements in this direction. Sabin's mucilage can is a convenience which many appreciate, particularly the advantages of the simple device for avoiding an excess of paste on the brush (see Fig. 622). A convenient device for applying paste may be easily prepared by pouring thin tragacanth mucilage into a four-ounce, wide-mouthed bottle and tying a double thickness of cheese cloth over the top. The bottle is kept inverted in a dish or lid and is always ready to apply the mucilage by simply rubbing the cheese cloth over the label. An excellent paste for prescription use is made from flour by the following process:

FLOUR PASTE

Flour (wheat)	**4 oz. troy**
Water	**16 fl. oz.**
Nitric Acid	**1 fl. dr.**
Oil of Cloves	**5 minims**
Boric Acid	**10 grains**

Thoroughly mix the flour, boric acid, and water, and strain the mixture through a sieve; add the nitric acid; apply heat, with constant stirring, until the mixture has thickened; when nearly cold, add the oil; strain it through coarse muslin if not perfectly smooth. This paste keeps well, and is much superior to tragacanth mucilage and ordinary paste. When required for pasting labels on tinned surfaces, the additional 10 per cent. of glycerin prevents labels from falling off after drying.

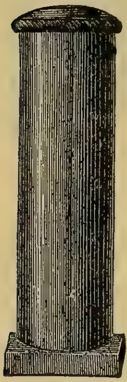
For some purposes a more adhesive paste is desirable, and a dextrin paste is recommended (see below).

DEXTRIN PASTE

White Dextrin	**1 lb.**
Syrupy Glucose	**2 oz. av.**
Aluminum Sulphate	**1 oz. av.**
Sodium Benzoate	**20 grains**
Water	**24 fl. oz.**

Mix the White Dextrin, Aluminum Sulphate, and Sodium Benzoate with a portion of the water, rubbing to a smooth paste; add the Glucose and the remainder of the water, and heat the mixture on a water-bath, with occasional stirring, until it has become translucent; strain if necessary.

Fig. 623



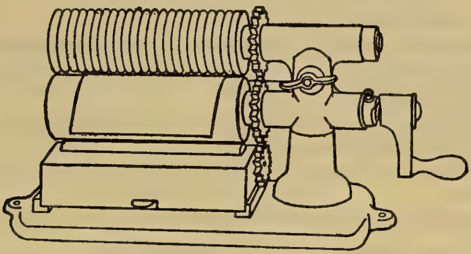
Label dampener

In applying a label which has been pasted, to a box, bottle, or can, care should be used not to touch with the fingers the portion of the label which has been recently written upon, even if it has the appearance of being dry. A piece of blotting pad or filtering paper, slightly larger than the label, should be laid upon it, and pressed gently, smoothly, and evenly, so that the excess of paste which has exuded upon the edges may be absorbed. If a label has had too much paste applied, and the excess has not been pressed out as described, it will have a wrinkled appearance. Labels should be neatly trimmed, showing a very slight but uniform margin around the border. They should be pasted upon bottles just above the centre, and never over the seams or mould marks, but half way between them.

Gummed labels, or labels printed on paper coated with a solution of dextrin, or gum, on one side, are used largely in some sections of the country. They appear to answer a good purpose in some localities where there is a dry atmosphere, but when used on the seaboard or in damp atmospheres considerable loss is often experienced from their sticking together. Fig. 623 shows a label dampener. It is a brass cylinder, having a tightly fitting screw cap, with a slightly perforated bottom covered with felt. The cylinder is filled with water, sufficient of which oozes through the perforation to keep the felt moist. Fig. 624 shows a hand machine for moistening gummed labels.

Arranging and preserving Labels.—A method of classifying labels must be adopted by each pharmacist which will be suited to his own requirements. The general rule is to arrange them in label drawers in the most convenient place in the store. The label drawers are preferably shallow, made of wood, and having compartments to receive the labels. Considerable space may be saved by having the compartments made of tinned iron instead of wood. The bottom of the drawer may be lined with cotton flannel, to prevent the labels from slipping underneath the tin divisions and becoming mixed by the continuous opening and closing of the drawer. It will be found convenient to separate the plain labels required constantly for articles in daily request from those of larger size or special design; and the former may be classified into labels for solids and labels for liquids. These may be arranged alphabetically in each drawer, so that they shall be quickly found. *A regular system should be adopted and rigidly carried out; and when a place has been once fixed for a label, it should never be changed,* as few trifles give more annoyance than inability to find a label in a pressing rush of business.

Fig. 624



Machine for moistening gummed labels

The upright label cabinets which have been contrived answer an excellent purpose where upright space can be spared.

QUESTIONS ON DISPENSING—PRESCRIPTIONS

What consideration must guide the pharmacist in selecting the location of a drug store? (See page 1566.)
What are the advantages of a corner store? What the disadvantages?
What should be the shape of the room? How may the space be best apportioned in such a room?
Name the general rules which should govern the window display.
What kind of wood is best suited for wall fixtures? Why?
Describe a convenient arrangement for the dispensing counter.
In the arrangement of the drug store, how should solid substances which are subject to injury from exposure to light be kept?
How should odorous drugs, such as valerian, be kept?
How should volatile oils be kept?
How should corrosive or deliquescent salts be kept?
How should poisons, alkaloids, and powerful substances be kept?
Describe a "salt mouthed" bottle, a "tincture bottle," a "syrup bottle," and "oil bottle." What are the advantages of a "recessed" label?

How may glass labels be fastened to the bottles? Describe a satisfactory prescription counter.

Describe the advantages of the Schwartz sectional fixtures.

Describe Holbe's poison closet. How may a mortar be held tightly when in use?

Describe the arrangement of a laboratory. Also of a cellar.

What general principles should guide the prospective drug clerk in starting business? What should be his appearance and general conduct?

How may he keep up stock? What rules should be followed when waiting on customers? In what way should he recommend goods?

What rules should govern the prescription department?

By what general rules should the clerk be governed in charging goods?

What should govern the sending out of goods?

With what precautions should poisons be sold?

What should be remembered about the soda counter?

What is the definition of the word "prescription"? (See page 1592.)

From what Latin word is it derived?

What are the advantages of using Latin in writing prescriptions?

What is meant by "the superscription" of a prescription, and of what does it consist?

What is used in French prescriptions?

Is it desirable to have the name of the patient written on the prescription? Why?

What is meant by the inscription?

Of what parts should a model compound prescription be composed?

Give the meanings of these various parts.

How does the physician usually ascertain the quantities desired of the various ingredients in writing a prescription?

Give the various characters used in Latin prescriptions, and write out their names in full in Latin.

What sort of numerals are used, and what position do they occupy in reference to the ingredients?

What is meant by "the subscription" to a prescription?

What is meant by "the signa" to a prescription?

Why should the name of the physician be attached to a prescription?

How should unusual doses in prescriptions be marked or designated?

What would be understood by the following abbreviations occurring in prescriptions?—Acid. hydroc.; aconit.; ammon.; aq. chlor.; calc. chlor.; chlor.; emp. lyt.; ext. col.; hyd. chlor.; hydr.; mist. ammon.; potass. hyd.; sod. hypo.; sod. sulph.; sulph.; zinc. phos.

Translate the following prescriptions, and also the accompanying directions:

Recipe Liquoris Ammonii Acetatis, drachmas tres cum semisse;
Vini Antimonii, drachmas duas;
Tincturæ Cardamomi Compositæ, drachmas tres;
Aquæ Menthæ Piperitæ, uncias quatuor.
Fiat mistura, cujus unciæ duæ omni horæ quadrante calefactæ sumendæ, durante frigore.

Recipe Rosæ Gallicæ, unciam dimidiam;
Aquæ ferventis, uncias octo.
Stent per horam; colaturæ adde Succi Limonum, Sacchari, ana, quantum sufficit, ad gratam acerbitatem dulcedinemque.

Recipe Extracti Colocynthidis Compositi, drachmam, unam;
Pulveris Scammonii, scrupulum unum;
Pulveris Cambogiæ, grana quinque.
Misce.—Fiant pilulæ viginti, quarum duæ deglutiantur horâ decubitus; diluculò, ut infra.
Recipe Infusi Sennæ, unciam unam.

Recipe Potassii et Sodii Tartratis, sesquidrachmam;
Cretæ Præparatæ, semidrachmam.
Misce.—Fiat pulvis in jusculo tenuissimo sumendus.

Recipe Ammonnii Carbonatis, grana sex;
Syrupi Aurantii, drachmas duas;
Aquæ, drachmas decem.
Misce.—Fiat hautus, cui, tempore capiendi, adde Succi Limonis recentis cochleare medium unum, et in effervescentiâ sumatur.

Recipe Tincturæ Opii, semidrachmam;
Spiritûs Chloroformi, drachmam;
Misturæ Cretæ.
Aquæ Menthæ Piperitæ, ana, uncias tres.
Misce.—Fiat mistura, cujus sumantur cochlearia duo magna post unamquamque sedem mollem, phialâ prius concussâ.

Recipe Misturæ Ammoniaci, uncias sex;
Tincturæ Opii, drachmam.
Misce.—Capiat cochlearia duo magna statim; iterentur post horam, si tussis accreverit.

Recipe Extracti Belladonnæ Fluidi, drachmam cum semisse;
Lini Farinæ, uncias duodecim;
Aquæ bullientis, quantum sufficit ut fiat cataplasma admovendum calidè loco adfecto.

Recipe Cetrariæ, unciam;
Aquæ frigidæ, octarium.
Coque ad uncias duodenas; stet ut geletur, et etatur æger gelatinâ ad libitum.

℞ Magnes. Carb., ʒi;
Pulv. Rhei, gr. xv;
Aq. Anisi, f℥iss.
M.—Fiat julep.[1] cujus unum cochl.[2] minim.[3] infant.[4] lacten.[5] detur, secundis horis: phialâ agitata.

℞ Sp. Ammon. Arom., fʒi;
Tinct. Asafœt., f℥ss;
Syrupi, fʒiii;
Aq. Cinnam., f℥i.
M.—Exhibe cochl. parv. ter quaterve de die, vel sæpius, urgente convuls.[6] vel spasm.[7]

℞ Tinct. Hyoscyami, fʒiss;
Pot. Acet., ʒiv;
Syr., fʒii;
Aq. Menth. Vir., ad f℥vi.
Ft. mist. cujus sumant.[8] cochl.[9] ii vel iii minim.[10] bis terve in die, vel ut opus sit.

℞ Tinct. Opii, fʒss;
Mist. Cret., f℥iii.
M.—Cap. cochl. ij magn.[11] omni quadrante horæ, donec leniat.[12] dolor.

℞ Pulv. Ipecac., ʒiss;
Pot. Bitart., ʒi;
Aq. fervent. f℥iiiss.
Macera per horam integr.[13] dein cola et adjice syr., fʒss.
M.—Detur ℥ss vel cochl.[14] ampl.[15] omni semihora, donec vomit.[16] proritav.[17]

℞ Plumbi Acet., gr. iv;
Syrup., fʒij;
Aq. Menth., fʒii.
M.—Cap. cochl. ampl.[18] mane quotidie; repetat.[19] dosis ad iii vices, et deinde cap.[20] æger haust.[21] aliq.[22] purgant.[23]

---

[1] Julepum. [2] Cochleare. [3] Minimum. [4] Infantulo. [5] Lactenti. [6] Convulsione. [7] Spasmo. [8] Sumantur. [9] Cochlearia. [10] Minima. [11] Magna. [12] Leniatur. [13] Integram. [14] Cochleare. [15] Amplum. [16] Vomitum. [17] Proritaverit. [18] Amplum. [19] Repeatur. [20] Capiat. [21] Haustum. [22] Aliquem. [23] Purgantem.

℞ Mist. Ammon.,[24] f℥vi;
Cap. æger cochl. mag. bis in die ex poculo jusc.[25] bov.[26]

℞ Morph. Acet., gr. ¼;
P. Colch.,[27] gr. iii.
Ft. pil. 4tis [28] horis s.[29]
Mitte vi fol.[30] arg.[31] inv.[32]

℞ Sodii Bicarb., ʒiii;
Ammon. Bicarb., ℈ii;
Pot. Nit., ʒss;
Syr. Aurant., f℥ss;
Ac. Hydrocyan. dil., gtt. xx;
Aquæ, ad ℥viij.
M.—Capiat ℥iss t. in d. cum pulv. i seq.[33] m.[34] stat.[35] effervesce.[36]

℞ Ac. Tart., ℈i;
Mitte chart. vi.

℞ Ol. Morrhuæ, f℥viij.
Sum.[37] coch. min. (ad. ampl.[38] augend.[39]) bis die c.[40] mist. sequent,[41] coch. ampl.[42]

℞ Acid. Phosph. dil., f℥ss;
Tinct. Nuc. Vom., fʒii;
Tinct. Calumb.,
Syr. Zingib., aa f℥i;
Aq. Cinnam., q. s. ut. ft. f℥viii.
M.—Ft. mist.

What are meant by gravimetric prescriptions?
What are the supposed advantages of this method?
What are meant by volumetric prescriptions?
What are the advantages of this method?
What relation does the mil or cubic centimeter bear to the gramme?
Write prescriptions according to each of these methods.
What general rules are to be observed by the clerk when receiving a prescription or order?
What procedure may be of assistance in reading the prescription before compounding it? Give rules to be followed in compounding the prescription.
What is meant by double checking?
Under what circumstances may additions or alterations be made in the prescription?
Name several methods of numbering prescriptions, giving advantages of each.
What is the value of a date attached to a prescription?
Why should the price always be placed upon the prescription?
What is a "cipher"? Give an illustration.
What is the "Evans' rule"?
Describe the N. A. R. D. pricing schedule.
Name the advantages and disadvantages of a prescription book for filing prescriptions.
Describe Lawrence's prescription box. Nesbitt's prescription file. Anderson's prescription file. Naulty's prescription file.
Why are labels to be attached to all packages sent from the drug store?
What rules should govern the selection of the style of labels?
How should poisonous substances be labeled?
How may labels be pasted on bottles satisfactorily?
What are the advantages and disadvantages of gummed labels?
How may labels be preserved and arranged?

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[24] Ammoniaci. [25] Jusculi. [26] Bovini. [27] Colchici. [28] Quartis. [29] Sumenda. [30] Folio. [31] Argenteo. [32] Involve. [33] Sequenti. [34] Mane. [35] Statu. [36] Effervescentiæ. [37] Sumatur. [38] Amplum. [39] Augendum. [40] Cum. [41] Sequentis. [42] Amplo.

CHAPTER LXV

EXTEMPORANEOUS LIQUID PREPARATIONS

Solutions, Mixtures, and Emulsions

OFFICIAL liquid preparations have been treated of in Part II. They will therefore not be considered in the present chapter, which will be confined to the extemporaneous compounding of liquids. It will soon be realized by the student that this branch of practical pharmacy involves some of the most intricate questions of physical and chemical science. The knowledge which he has heretofore acquired of the solubilities of solids in various solvents, simple and compound, the solubility of liquids with one another, chemical decompositions, reactions between acid and alkaline salts, precipitation through single and double decomposition, etc., will often be of great service. This, coupled with practical experience, together with the exercise of original ingenuity, must be depended upon to meet the perplexing questions which continually arise. See autograph and facsimile prescriptions, pages 1603 to 1638.

Extemporaneous liquid preparations may be classified as follows: 1. *Solutions*, by which are meant liquid preparations containing dissolved solid substances. 2. *Mixtures*, liquids in which the solution is but partial, insoluble particles being held in suspension. 3. *Emulsions*, preparations containing oily or resinous substances mixed with water so as to form homogeneous liquids. These will be considered *seriatim*.

SOLUTIONS

The methods generally employed in making official and other solutions have been treated of in the preceding chapters, and it must be presumed that the reader is familiar with them. Most of the difficulties encountered in effecting solutions required by prescriptions arise from the want of knowledge on the part of prescribers of the solubilities and of the physical and chemical characteristics of the medicinal agents which they order to be compounded. It is necessary, therefore, for the pharmacist to be well grounded in these particulars, while therapeutical knowledge must not be neglected either, lest the addition of some apparently inert substance, intended to improve the preparation pharmaceutically, be injurious therapeutically.

Incompatibility.—The subject of incompatibility must be thoroughly comprehended, and, inasmuch as it occurs in solid preparations as well as liquids and is of far reaching importance, it will be considered at length and under a separate head (see Chap. LXVI).

COMPOUNDING EXTEMPORANEOUS SOLUTIONS

Use of Heat in compounding Extemporaneous Solutions.—As a general rule, it is not advantageous to aid the solution of a solid by heating it in contact with the solvent, except where the quantity of liquid is known to be in excess of what is required to form a solution, and such a liquid should never be dispensed until it has become cool. If the solid be crystalline, the excess will surely separate in crystals when the liquid cools, and the patient will become uneasy and suspicious, fearing lest some mistake has occurred. It frequently happens that more of a solid has been prescribed than can be dissolved in the amount of liquid desired; indeed, it is entirely too much to expect that every practitioner should carry in his mind the exact solubilities of all the solids that he prescribes in the respective liquids in which he may wish to dissolve them. This gives the pharmacist another opportunity to use his knowledge and judgment, and the problem

When to filter is oftentimes perplexing, although one simple rule should govern the practice: *A solution may be filtered and dispensed as a transparent liquid when the removal of the excess does not interfere with the medicinal properties and action of the medicine, nor conflict with the obvious intention of the prescriber.*

Solutions of potassium chlorate, to be used as gargles, are good illustrations:

℞ Potassii Chlorat. ʒiv
Phenolis gtt. xv
Infus. Salviæ f℥vi.
Sig.—Use as a gargle.

The quantity of the salt here is about twice too much, and, as the solution is intended as a gargle to inflamed surfaces, the undissolved particles of potassium chlorate would probably act as irritants. They can be of no use in the solution, and in this case filtration is perfectly admissible. The following prescription should not be filtered, and the pharmacist is compelled to rely solely upon his judgment and knowledge of the therapeutical action and properties of the ingredients:

℞ Magnesiæ Pond. ʒiss
Massæ Hydrarg. ʒss
Sacch. Alb. ʒi
Spt. Ammon. Arom. fʒii
Aq. Menth. Pip. ℥ii
Aq. Calcis f℥iii
Sig.—A tablespoonful every two hours.

The reasoning here would be direct and simple. The prescriber evidently intends this to be an alkaline cholagogue mixture, although the directions to "shake the bottle" have been omitted. Heavy magnesia and blue mass are both practically insoluble in the liquids, and if they are filtered or strained out the mixture is deprived of its most important constituents. It should be dispensed as a mixture, and a "shake" label used.

Aids in effecting Solution.—The use of solvents which are not directed in the prescription, for the purpose of effecting the complete solution of the ingredients, requires probably the greatest amount of good judgment. The practice is one which is liable to great abuse, and a strict rule should be enforced that no addition is admissible under any circumstances except one which is absolutely demanded by necessity and which will in nowise impair the therapeutical effect. The prescriber should have reason to place implicit reliance upon the compounder and feel satisfied that the patient has received exactly what was ordered. The following is a good illustration of a case requiring an addition; a physician prescribed it as an application for dry, excoriated nipples:

℞ Acidi Carbolici gr. xl
Aquæ f ℥ss.
Sig.—Solution Carbolic Acid. Use with a camel's hair brush.
Dr. W.

Phenol or carbolic acid is not soluble in water in the proportions named, only about 1 part dissolving in 15 parts of water. The pharmacist dispensed the prescription just as it was written, with the excess of phenol in the bottom of the bottle. The patient inserted the camel's hair brush and permitted it to remain in the bottle, so that it reached the bottom and became saturated with the undissolved phenol. The application produced severe pain and alleged serious injury, and became the ground for a civil suit for damages against the pharmacist, brought by the patient. If the pharmacist had added a small quantity of glycerin, all difficulty would have been avoided, and he could then have dispensed a perfect solution. It is hardly necessary to say that the physician should not have omitted prescribing the glycerin; but, as he failed to do so, it was the duty of a careful pharmacist to inform him of the facts, or, failing to find him, to supply the deficiency and subsequently notify him of the addition.

The order to be followed in mixing the ingredients is frequently very important, and many prescriptions which at first sight appear to contain incompatibles will be easily compounded by observing the proper order in mixing. As has been shown, precipitation frequently takes place when one liquid or solution is added to another, and this annoyance is much more apt to occur when concentrated solutions are brought together. Hence the dilution of the solution is recommended as one method of avoiding precipitation. An illustration is afforded in the following:

℞ Liq. Ammon. Acet. f ℥iv
Acidi Acetici f ʒ i
Tr. Ferr. Chlor. f ℥ss
Glycerini f ℥ss
Mucil. Acac. ad f℥viii
Sig.—A teaspoonful every three hours.

If the tincture of ferric chloride be mixed with the acetic acid and glycerin, and then added to the solution of ammonium acetate, and this solution mixed with the mucilage of acacia, no gelatinization will occur; but if the tincture of ferric chloride be added to the mucilage, undiluted, a gelatinous precipitate will form, and, although the subsequent addition of the other ingredients will, in time, dissolve the precipitate, this time could be saved by following the proper order. Then, again, in the following:

℞ Hydrarg. Chlor. Corr. gr. iii
Mucil. Acac. f℥i
Aquæ
Liq. Calc. aa f℥ii

If the corrosive mercuric chloride be dissolved in the water and then mixed with the mucilage, and the lime water added subsequently, no precipitation will occur; but if the corrosive mercuric chloride be added to the lime water and then to the other ingredients, the yellowish red mercuric oxide will be formed, which is insoluble in the liquid.

The following rule should be insisted upon: *Whenever a difference in the appearance of a liquid is produced by a variation in the order of mixing, a memorandum noting the order should be made upon the prescription at the time it is compounded, so that in case of renewal the same order may be followed.*

MIXTURES

Mixtures, properly speaking, are aqueous preparations intended for internal administration, containing some insoluble substances, with frequently viscid or sweet liquids to aid in suspending them. The official mixtures have been already noticed (see page 360). The term mixture, however, is indiscriminately applied in extemporaneous pharmacy and in prescriptions to aqueous solutions of all kinds. For instance, solution of potassium citrate is frequently termed "fever mixture," although it is a perfectly transparent solution.

EMULSIONS

Emulsions are opaque liquid preparations of a thick consistence, in which oily or resinous liquids are suspended by the agency of gummy or viscid substances. They may be conveniently divided into two classes as follows: (See Emulsa, page 354.)

1. **Natural emulsions** are those which are found in nature, as the milky juices of plants, the milk of animals, yolk of egg, etc.
2. **Manufactured emulsions** are those made artificially by various processes. The art of producing them is termed *emulsification.*

Manufactured emulsions are usually made from two classes of substances: 1. Those which contain an oily or a resinous compound associated *naturally* with gum or some other emulsifying agent. 2. Oils, fatty, and resinous bodies containing no emulsifying substance.

Gum resin emulsions and seed emulsions belong to the first class. They are usually made by simple trituration in contact with water.

Gum resin emulsions are made by reducing to a coarse powder, in a mortar, selected pieces of the gum resin, triturating with a small quantity of water so as to form a smooth, uniform paste, and then adding the remainder of the water, finally straining the mixture. (See Emulsum Asafœtidæ, page 356.) Powdered gum resin should never be used for making emulsions, because of the loss or deterioration of the volatile constituents when the substance is dried so that it may be powdered.

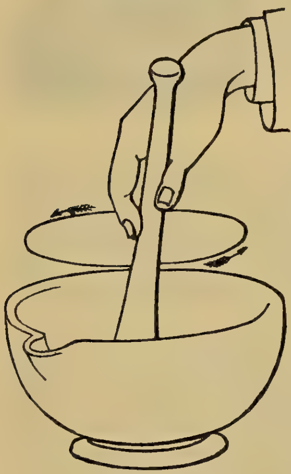
Seed emulsions are so termed because they are made by rubbing seeds or the kernels of fruits which contain fixed oils with water, the emulsifying agent being a gummy or albuminous substance found naturally in the seed or kernel associated with the oil. Emulsions of almond, castor oil bean, croton oil bean, etc., are examples of this kind. (See Emulsum Amygdalæ, page 355.)

The theory of emulsification is based upon a study of the best type of a natural emulsion,—namely, milk. This liquid is found, on examination, to consist of innumerable globules of a fatty substance (butter) enveloped in a thin membrane of viscid matter (casein) suspended in water. The object sought by the pharmacist in making emulsions is first to thoroughly divide the oily or resinous liquid into minute globules, and then to surround each globule with an adhesive envelope (mucilage of acacia, yolk of egg, etc.). The globules, when completely enveloped, are suspended in water, and if the emulsion is properly made, there will be no tendency on the part of the oily or resinous liquid to recombine. The physical chemist has devoted much time to the study of the theory of emulsification and certain terms are frequently used in referring to emulsions and should be understood. It is recognized that an emulsion is a distribution of one liquid, in the form of very fine droplets, throughout another liquid, some agent such as acacia being used to separate them. The liquid which is divided into tiny drops and distributed is termed an *internal* or *disperse phase,* while the liquid in which it is suspended is known as the *external phase* or the *dispersion* medium.

Two classifications of emulsions are made, known as *oil-in-water* class and *water-in-oil* class, the distinction being made by determining which liquid is in excess. Most pharmaceutical emulsions, like cod liver oil emulsion, are of the first class, while carron oil belongs to the second class. (See Roon and Oesper, *J. I.* and *E. C.*, 1917, page 156.) Several methods are employed in making emulsions, the most important of which, however, may be grouped under *two* typical methods, named from the geographical locations where they are used most frequently: 1. The English method. 2. The Continental method. Both are equally useful, and should be employed according to circumstances.

1. **The English Method.**—In this mode of making emulsions the emulsifying agent, consisting of mucilage, yolk of egg, etc., is first placed in a dry mortar, and small quantities of the oil and water are gradually and alternately added at intervals. The pestle is rapidly and lightly rotated in the direction of the arrows (see Fig. 625), with the effect of dashing the oil into globules, which are at once enveloped by the viscid emulsifying agent. If the oil or water is added too rapidly at the beginning, or the mucilage has not been thick enough, the accident of "*cracking*" the emulsion occurs. This may be known by the "pearly" appearance assumed by the mixture, and on close examination the globules of unenveloped oil may be seen floating about. If each stage of the process is successful, the emulsion presents, upon thorough mixing after each addition, a smooth, opaque, glistening appearance like cream. Success depends largely upon the care exercised in forming the nucleus at the beginning, and this, therefore, should not be too hastily made. When an emulsion is "cracked," it need not be thrown away. It may be restored by placing an additional quantity of mucilage in the mortar and gradually adding the "cracked" emulsion to it,

FIG. 625



Making an emulsion

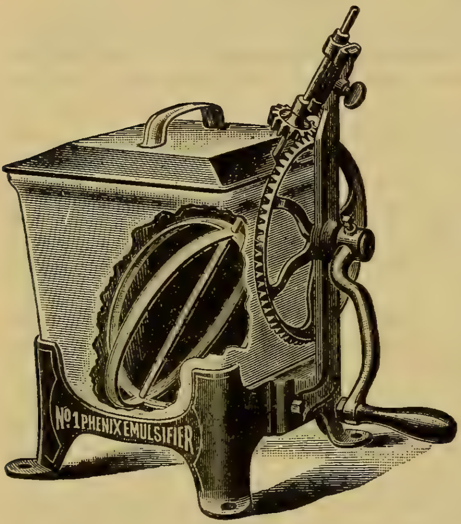
triturating after each addition, when finally the satisfaction of seeing the uncombined globules disappear will generally be experienced.

The English method of making emulsions is the best to use in general prescription practice, where the proportions of gum, oily or resinous liquids, and water must necessarily vary. A typical formula is appended :

℞ Olei Morrhuæ f℥ii
Pulv. Acaciæ ℥ss
Aquæ q. s. ft. f℥iv.

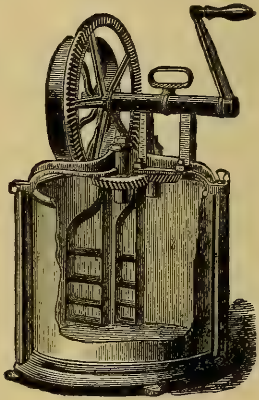
Place the acacia, which should not be finely powdered, but granulated, in a mortar with one fluidounce of water. This should be triturated until the mucilage is perfectly smooth and free from lumps. The oil should be added at first in quantities not greater than half a fluidrachm at a time, stirring rapidly with the pestle after each application, care being taken not to add a fresh portion of oil until the last has been thoroughly emulsified. When the liquid becomes too thick to be easily stirred, a fluidrachm of water should be mixed with it, and the gradual additions of oil continued until the whole quantity has been used. The larger quantity of water may be added rapidly after the nucleus is once properly formed, without risk.

Fig. 626



Emulsifier

Fig. 627



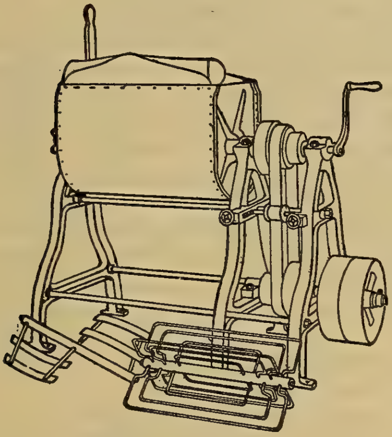
Sparrow mixer

2. **The Continental Method.**—This has the great merit of never failing to produce a good emulsion if the proper proportions are used to form the nucleus, and if the directions are strictly followed. The most satisfactory proportions may be easily remembered. Half as much water is taken as of oil, and half as much gum as of water ; or it may be expressed as oil, 4 ; water, 2 ; gum, 1. The four parts of oil must be placed in a dry mortar and one part of finely powdered gum added to it, stirring with the pestle ; when a uniform mixture is made, two parts of water are added, not gradually, but all at once, when, upon stirring, the emulsion is quickly

made. An additional quantity of water may be added to this nucleus without risk. The explanation of making an emulsion by this method is, that the particles of gum, being insoluble in the oil and surrounded by it, are prevented from separating and dissolving in the water so as to form lumps; by stirring the mixture actively the water *gradually* dissolves the gum, the oil becomes incorporated at the same time, and a homogeneous mixture is produced, the quantities of oil, gum, and water being in exactly the right proportions to form an emulsion.

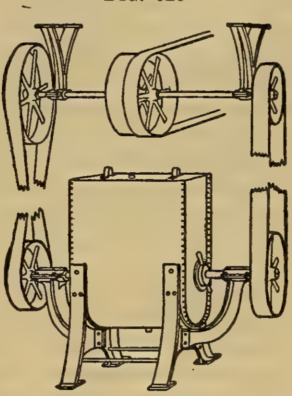
In making large quantities of emulsions some mechanical device must be used to facilitate the rapid stirring and agitation necessary to form the nucleus. Fig. 626 represents an emulsion apparatus or egg beater made by the Whitall Tatum Company. The principle of action is so well shown here that a description is unnecessary. If emulsions are to be made in still larger quantities, the sifter and mixer shown in Fig. 256 can be used by taking out the sieves and lining the receiving box with tinned copper or otherwise making it waterproof, thus using only the mixer.

Fig. 628



Clipper emulsifier

Fig. 629



Hall's emulsion machine

The Sparrow mixer is shown in Fig. 627. In this ingenious apparatus two stirrers are made to revolve by turning the gear wheel, and a very rapid and effective motion may be imparted.

Fig. 628 shows the Clipper emulsifier made by the J. H. Day Company of Cincinnati. The tank is mounted on a strong frame, and can be easily tilted to remove the emulsion when finished; the agitators are shown in the foreground. With this machine a large quantity of emulsion can be made quickly. Fig. 629 shows another form, an emulsion machine made by A. B. Hall, of Indianapolis; it is capable of making from a barrel to a barrel and a half of emulsion at each charge, the power being conveyed by a shaft, belts, and pulleys from above.

Casein Emulsions.—The use of casein as an emulsifier has been developed by Léger, a Parisian pharmacist. He recommends the preparation of *saccharated casein,* a fine white powder, which is used for emulsifying just as is powdered acacia. It is claimed that casein emulsions are more readily retained by the stomach, and that greater stability and perfection are secured through its use.

Saccharated casein is prepared by heating one gallon of cow's milk to 104° F., adding two fluidounces of ammonia water, allowing the whole to stand a day, and separating the lower milky liquid from the oily liquid on top. The milky liquid (*lactoserum*) is treated with acetic acid until the casein is precipitated. After washing the precipitate thoroughly with water at 104° F. it is collected on a muslin strainer and pressed; a weighed portion of the casein is dried and the percentage of moisture ascertained; the damp casein is then triturated with three and a half ounces of powdered sugar and eight parts of sodium bicarbonate for every one hundred parts of dry casein.

Prolonged trituration and the addition of more powdered sugar, until it amounts to nine parts in one hundred, result in the formation of a paste, which must now be dried by a gentle heat not above 86° to 90° F. After complete drying, it is powdered and sifted. To make a casein emulsion of a fixed oil, fifteen parts of the oil are gradually incorporated with a mucilage previously made with fifteen parts of saccharated casein and five parts of water. When a perfect emulsion is formed the other ingredients are added. Powdered casein is a commercial product to-day and is used for emulsifying oils.

Emulsifying Powders.—A typical combination known as *emulsifying powder* is made by thoroughly mixing equal parts of finely powdered tragacanth, sugar, acacia and starch. Another combination consists of 10 parts of tragacanth, with 5 parts each of acacia and gluten. About 4 Gm. of the powder should be used for each 30 mils of oil, using the English method.

Condensed Milk.—This substance has also been used as an emulsifying agent, the English method being followed.

Chondrus Emulsions.—Since acacia is subject to fluctuations in price and is often expensive, various substitutes have appeared which have been tried as emulsifying agents, one of the most successful being the gelatinous substance obtained from Irish moss. (See page 353.)

Quillaja Emulsions.—*Quillaja,* or *quillaya bark* (see page 1280), contains the principal saponin, a glucoside which is capable of emulsifying oils. This property, causing frothing in aqueous solutions, suggested the use of quillaja as an emulsifier. It has not come into extensive use, and care is necessary in employing it, as it is not without medicinal and irritating properties.

In applying the principle of emulsification to technical uses other emulsifying agents are employed, such as soap, gelatin, etc.

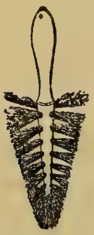
Preservation of Emulsions.—While the official emulsions are supposed to be extemporaneous preparations, it is often necessary to make stock preparations in which decomposition will not occur. For this purpose the flavoring oils are often helpful, especially methyl salicylate, but it is usually desirable to add a preservative like sodium benzoate, one-tenth of one per cent. or 8 to 10 per cent. of alcohol. The latter not only preserves the emulsion but helps to maintain a fluid consistence. Alcohol should be added last and in small portions, shaking the emulsion after each addition.

Compound Emulsions.—As a general rule, the addition of alcoholic liquids to emulsions destroys their homogeneity. When it is necessary to add them in compounding prescriptions, they should be diluted, if possible, with a portion of the water, and added after the emulsion is nearly finished. Alkaline solutions generally aid emulsification, by forming soaps with the resinous or oily liquids; volatile oils make better emulsions if they are first mixed with an equal volume of fixed oil.

THE DISPENSING OF LIQUIDS

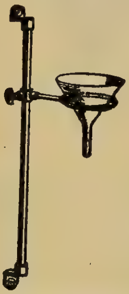
Every convenience should be adopted to facilitate quick and accurate dispensing. The sink should be close to the prescription counter. A good draining surface for graduates to rest upon is made by fastening sheets of corrugated rubber (a piece of rubber matting) to the slightly inclined shelves above the sink (see Fig. 142), and a brush for quickly cleaning graduates should be accessible (see Fig. 629*a*). In addition to the retort stand already referred to, the very convenient little funnel support may find a place upon the prescription counter (see Fig. 629*b*). The long rod which is screwed to an upright part of the counter fixtures permits the ring to be adjusted to any desired height. For larger filtering operations the funnel board (Fig. 630) will prove useful.

Fig. 629*a*



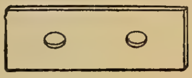
Graduate brush

Fig. 629*b*



Funnel support

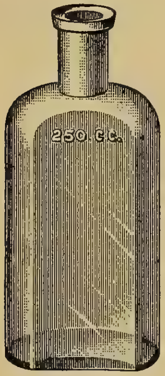
Fig. 630



Funnel board

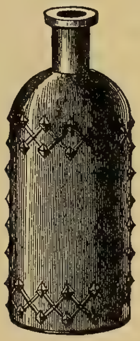
Bottles.—The size and shape of the bottles used in dispensing liquids are largely matters of individual taste. The tendency at present is toward oval bottles for prescriptions, because they afford proportionately more space for the label than either round or square bottles. This is noticeable to a greater extent in the smaller sizes than in the larger ones. In addition to this, oval bottles are more

Fig. 631



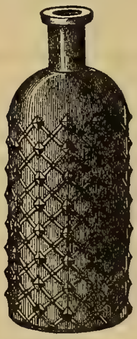
Oval metric bottle

Fig. 632



Poison bottle

Fig. 633

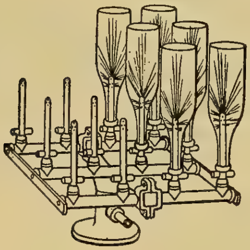


Poison bottle

convenient to carry in the pocket than those of any other shape. Fig. 631 shows an oval metric bottle.

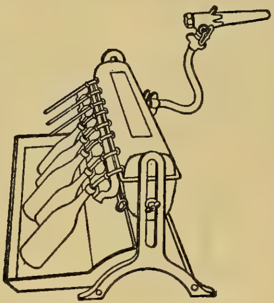
Prescription bottles are now frequently made of amber glass, to protect the contents from the effects of the actinic rays of light. For poisonous liquids, or for liquids intended for external application, blue bottles studded at regular intervals with pyramidal points are used. These are designed to attract attention through their peculiar color and shape, and thus prevent errors; the points render them easily distinguishable from ordinary bottles by the sense of touch, so that the patient can recognize a poisonous liquid in the dark. Figs. 632 and 633 show two sides of this bottle.

Fig. 634



Turntable rinser

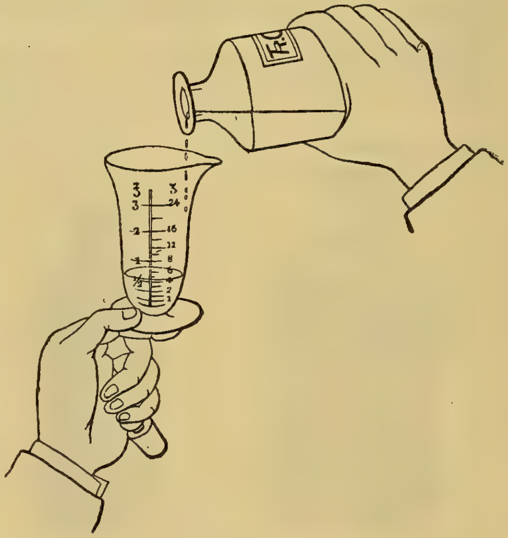
Fig. 635



Bottle filler

Washing Bottles.—The cleaning of bottles is generally a despised occupation. Where a large number of bottles of one kind and shape are to be washed, the machine shown in Fig. 634, made by the J. H. Day Company, of Cincinnati, known as the turntable rinser, may be used with advantage. The water is supplied automatically, and may be shut off by a quarter turn of the rinser; this permits continuous rinsing without undue waste of water.

Fig. 636

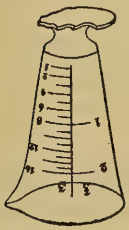


Pouring from shop bottle

Bottle Fillers.—In Fig. 635 a bottle filler made by the J. H. Day Company, of Cincinnati, is shown which automatically fills a bottle placed on one of the tubes, and when the bottle is full the liquid stops flowing. It is obvious that a continuous filling may be carried on by connecting a bottle with the first tube, and then another with the second, and so on until the last tube is reached. The first bottle may then be removed (filled), and if an empty one be slipped over the tube, and this repeated in turn with the others, they can all be filled rapidly and easily.

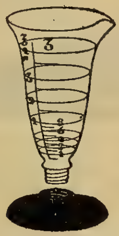
Pouring Liquids.—In pouring liquids from the dispensing bottles, it is well to establish the habit of extracting the stopper with the left hand, holding it with the little finger. The graduate is held between the forefinger and thumb of the left hand, or, more securely, by allowing it to rest on the middle finger of the left hand, the forefinger and thumb grasping the graduate above the base, while the bottle is held in the right hand with the label uppermost (see Fig. 474), and the liquid poured down the side of the graduate to avoid splashing (see Fig. 636). Fox, Fultz & Co. have placed upon the market a graduate with a hard rubber base (see Fig. 638) as the base of an ordinary graduate is apt to be chipped or broken by use (see Fig. 637).

Fig. 637



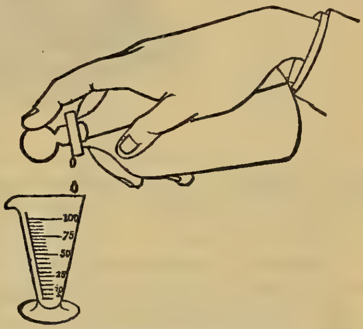
Graduate (chipped and broken base)

Fig. 638



Graduate, with hard rubber base

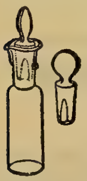
Fig. 639



Dropping from shop bottle

Dropping Liquids.—Fig. 639 shows the method of dropping liquids from a dispensing bottle. The stopper is loosened, prevented from dropping out by holding it with the finger, and the bottle inclined so that the rate of dropping may be controlled. Fig. 640 shows a very convenient bottle for dispensing liquids which are to be administered by drops. It was originally made in Germany, but is now made by the Whitall Tatum Company. The glass stopper has a deep conical depression extending nearly half way up the side, while the neck of the bottle is furnished with an aperture having a slightly projecting lip. When the stopper is turned so that the upper part of the depression is opposite the little aperture in the side, the liquid may be dropped very uniformly. A corresponding depression on the opposite side of the stopper communicates with a little channel running down from the lip upon the opposite side of the bottle, so that air is supplied during the dropping. By turning the stopper half way around, both apertures in the neck of the bottle are closed.

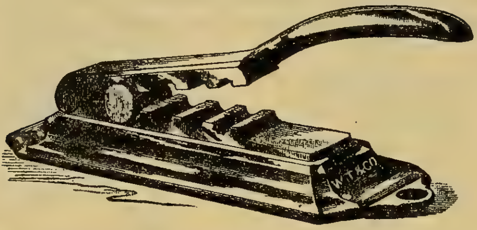
Fig. 640



Dropping bottle

Corks are indispensable for stoppering bottles. They should be selected with great care. There is a wide difference in price between the best quality and the common grades, but it is true economy to use only the best. Short corks, which, when inserted tightly, so as to secure the contents from leakage, do not project above the lip sufficiently to furnish a good grasp for the fingers when extracting them, should never be used for prescription bottles. Brittle, hard, or dry corks, which break off when the attempt is made to remove them, are an especial annoyance. To avoid this, corks should not be kept in a warm, dry place, but if very dry, they should be moistened by dipping them in water for an instant, and then they should be well pressed. "Taper" corks are now invariably preferred to the "straight" form.

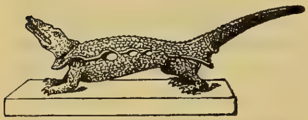
Fig. 641



Cork press

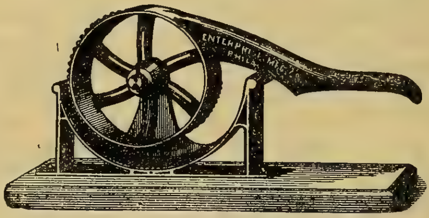
Pressing Corks.—Fig. 641 shows a modern form of cork press which is largely used. The motion by which the pressure is affected is direct and simple. Pharmacists who incline to the grotesque in their tastes may prefer the kind shown in Fig. 642, but the practical dispenser will generally choose Lochmann's cork press (see Fig. 643), because the process of pressing the cork is more effectual, and there is less likelihood of breaking it or cracking the surface in this press than in any other, for the cork is revolved while the pressure is gradually increased. The press consists of a cast iron base, the upper portion of which is hemispherical, with the upper surface slightly corrugated; a corrugated cast iron wheel is placed upon an axle slightly out of the centre of the curve of the base, so as to afford a gradually diminishing space between the curved surfaces. The wheel has a handle, which is raised when the tapered end of the cork is inserted between the surfaces; the handle is lowered, and the cork revolves while being pressed.

Fig. 642



French cork press

Fig. 643

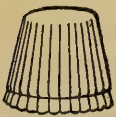

ENTERPRISE MFG. CO. PHILA.

Lochmann's cork press

Gummed Cork Tops.—A finish may be given to corks by the use of "gummed cork tops." These are circular in form, made of paper, and the name of the pharmacist, or his monogram, is generally printed upon them in colors. These tops have largely supplanted the sealing wax finish so much used a few years ago.

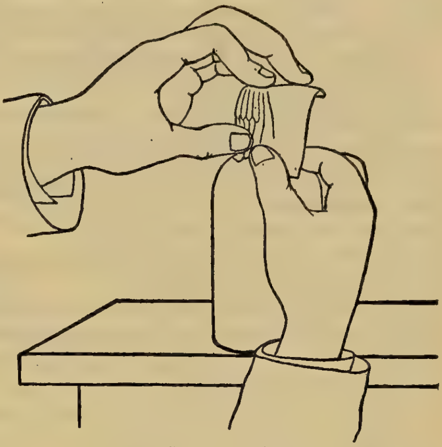
Capping Bottles.—The practice of capping bottles with paper, kid, baudruche, or other material is a good one, principally because of the feeling of security it gives to the patient that the contents of the bottle have not been tampered with after being dispensed. Hunt's bottle caps (see Fig. 644) are largely employed. These consist of fluted caps of colored paper, of various sizes, which are used by adjusting the proper sized cap to the corked bottle and tying it on. An equally neat effect may be secured, with a little practice, by capping a bottle with a piece of fancy paper, as shown in Figs. 645 and 646. The paper is held in the centre upon the cork by the forefinger of the left hand, while the flutes are made by "plaiting" them in with the forefinger and thumb of the right hand. It is then secured by tying with twine, a knot with short ends being preferred, because it is less likely to be interfered with by a messenger, on account of the difficulty of retying it. After tying, the "excess" of paper is trimmed off by using scissors with sharp points.

FIG. 644



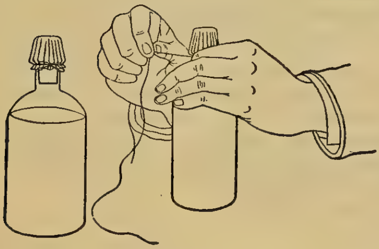
Hunt's bottle cap

FIG 645



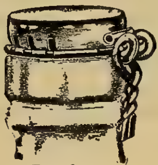
Capping bottles

FIG. 646



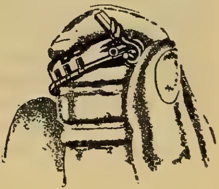
Tying the cap

FIG. 646a



Bottle cap

FIG. 646b



Bottle cap open

Bottle Caps.—Metal caps for closing bottles are extensively used for mineral waters and other liquids. They usually require a special machine for attaching the cap, as described under solution of magnesium citrate (see page 805), but The Williams Sealing Corporation, Waterbury, Conn., have devised a cap which may be readily attached or removed from the bottle. The lip of the bottle must be specially adapted to the use of this cap (see Fig. 646a and 646b).

QUESTIONS ON EXTEMPORANEOUS LIQUID PREPARATIONS

In compounding prescriptions, as a general rule, should heat be used in making solutions of solid substances? Why? (See page 1661.)
When may mixtures which contain more solid material than can be dissolved be filtered before being dispensed?
Give an example.
Give an example where such a mixture should not be filtered.
Is the apothecary justified in using solvents not directed in a prescription, for the purpose of effecting complete solution of the ingredients?
Is the order to be followed in mixing the ingredients of a prescription of any special importance? Why?
Where a difference results from a variation in the order of mixing the ingredients, what rule should be adopted to secure uniform results?
What are mixtures, properly so called?
Is this definition adhered to in extemporaneous pharmacy?
What are emulsions?
From what are manufactured emulsions usually made?
How are gum-resin emulsions made?
Should powdered gum resins be used in making these? Why?
What is meant by seed emulsions?
What is the object sought by the pharmacist in making emulsions?
What is the English method of making emulsions?
What is meant by "cracking" an emulsion?
How may a cracked emulsion be restored?
What is the Continental method?
What are the most satisfactory proportions of the ingredients to be used?
How are casein emulsions formed?
How is saccharated casein prepared?
What are "emulsifying powders"?
In what form may milk be used as an emulsifying agent?
What are chondrus emulsions?
How is chondrus prepared for use as an emulsifying agent?
Explain the use of quillaja as an emulsifier.
How may emulsions be preserved?
When it becomes necessary to add alcoholic liquids to emulsions, what precautions are necessary to make a smooth emulsion?
How may emulsions of volatile oils be rendered more stable?
How may the sink at the dispensing counter be made most convenient?
What is a "poison bottle"?
When should amber glass bottles be used in prescription work?
How should liquids be poured from the shelf bottle into a graduate?
How may liquids be dropped from the shelf bottle?
What are the advantages of a hard-rubber-base graduate?
What precautions should be taken in preparing a cork for use?
Describe the Lochman's cork press. What are its advantages?
How may bottles be capped? Why should they be capped?

CHAPTER LXVI

INCOMPATIBILITY IN PRESCRIPTIONS

INCOMPATIBILITY may be defined as a term used to express the effects produced in pharmaceutical mixtures by chemical decomposition, physical dissociation, incomplete solution, or therapeutical opposition. For the purposes of study the subject may be considered under two heads, according as it occurs in *liquids* or in *solids*, and these divided into three classes,—*chemical incompatibility, physical incompatibility,* and *therapeutical incompatibility.*

CHEMICAL INCOMPATIBILITY OCCURRING IN LIQUIDS

Chemical incompatibility is that form which is the result of chemical action and which invariably results in the decomposition of one or more of the ingredients entering into the prescription. It must not be assumed, however, that this decomposition is always unintentional on the part of the prescriber.

Chemical incompatibility occurring in solutions, mixtures, lotions, liniments, etc., may result in: I. Production of a precipitate. II. Evolution of a gas. III. Changes in color. IV. Decomposition caused by chemical action producing heat. V. Immiscible liquids formed by reaction between chemical substances.

I. Production of a precipitate.—When a precipitate is formed in a prescription the first thought must be, Is the precipitate active or inert? then, Has the physician intended to produce the precipitation? for incompatibility may be either intentional or unintentional.

Chemical incompatibility is a condition which is very likely to be misunderstood. It does not follow that because precipitation ensues when two transparent liquids are mixed, or in any other way, the decomposition was not intended. Cases of this kind demand good judgment on the part of the pharmacist. This may probably be best illustrated by the following examples:

℞ Plumbi Acetat. ʒss
Zinci Sulphat. gr. xv
Aq. Rosæ f℥iv
M.
Sig.—Use as an injection.

The novice would be very apt to imagine that the doctor had made a mistake in writing this, or was sadly deficient in chemical knowledge not to be aware that decomposition would take place here, that the insoluble lead sulphate would be formed, and that the astringency of the salts would be destroyed; but the experienced pharmacist would know at once that he must not filter this prescription, but dispense it with a "shake" label, because the precipitated lead sulphate is the really important agent. A very different case is presented in the following, which may be cited as an illustration of chemical incompatibility arising from lack of knowledge of the solubilities of the salts on the part of the prescriber :

℞ Quininæ Sulph. gr. x
Potassii Acet. gr. xx
Acid. Sulph. Dil. gtt. v
Aquæ Cinnamomi f ℥ i
M.
Sig.—A tablespoonful every three hours.

The usual procedure would be either to dissolve the quinine salt in the cinnamon water with the aid of the diluted sulphuric acid, and then add the potassium acetate, or to make separate solutions of each, and then mix them. In either case the result would be the formation of a voluminous precipitate of quinine acetate, preventing the possibility of carrying out the directions to the patient of taking a tablespoonful, because it could not be poured. Although this precipitate could be dissolved in acetic acid or alcohol, so much would be required of either that the character of the prescription would be materially altered ; hence quinine sulphate and potassium acetate should never be prescribed together in solutions.

Precipitates may be produced in several ways, as follows :

1. An insoluble salt resulting from reaction between two salts in solution. 2. Reduction of salts by chemical reaction. 3. Insoluble hydroxides resulting from the action of a soluble salt upon a carbonate or hydroxide. 4. Precipitation of alkaloids or alkaloidal salts by alkalies, alkaline salts, general alkaloidal precipitants, or substances producing insoluble compounds. 5. Precipitation of a weak acid from its salt by the addition of a stronger acid. 6. Separation of a gelatinous precipitate.

1. *An insoluble salt resulting from reaction between two salts in solution.*—This form of precipitation is very common. A knowledge of the properties of many chemical compounds is necessary to deal with incompatibility of this kind. The prescription given below illustrates this fact.

℞ Magnes. Sulph.
Pot. et Sod. Tart., āā ʒ i
Sodii Phosph. ʒ ss
Tinct. Capsici ♏ xx
Aquæ ad f ℥ ii

A white, flocculent precipitate of magnesium phosphate at once appears. If permissible, the addition of a small quantity of tartaric acid will dissolve the precipitate.

The following list of incompatible combinations are classed under this head :

Arsenic trioxide when in solution is precipitated by ferric hydroxide or dialyzed iron as an insoluble arsenite.

Benzoates.—The soluble benzoates precipitate ferric salts when in neutral or nearly neutral solutions.

Borates.—Sodium borate and other alkaline borates precipitate salts of several of the metals when in neutral solution, as mercuric chloride, silver nitrate, lead acetate, barium chloride, calcium chloride, alum, zinc sulphate, and ferric salts.

Chromates and Bichromates.—The soluble chromates and bichromates precipitate salts of lead, silver, mercury, and bismuth when in aqueous solution.

Hydriodic acid and the soluble iodides produce precipitates in aqueous solutions of lead and silver salts and with mercurous and mercuric compounds, the precipitate usually being soluble in an excess of either substance.

Hydrobromic acid and the soluble bromides produce precipitates with soluble lead, silver, and mercurous salts. The precipitate formed with mercuric compounds is soluble in an excess of either salt.

Hydrochloric acid and the soluble chlorides precipitate the soluble lead, silver, and mercurous salts, from their solutions, as chlorides.

Hypophosphites.—The alkaline hypophosphites when added to solutions of ferric salts produce a precipitate of ferric hypophosphite, which is soluble in the presence of sufficient alkaline citrate.

Lead acetate is precipitated from solution by the soluble carbonates, sodium borate, soluble sulphates, bromides, iodides, chromates, sodium phosphate, and tannic acid.

Mercuric chloride (corrosive sublimate) is precipitated when in solution by the fixed alkaline hydroxides. The precipitate, if the alkali be in excess, is yellow mercuric oxide, as in the case of "yellow wash," in which lime water is the precipitant. Ammonia water and ammonium carbonate precipitate ammoniated mercury when added to solution of corrosive sublimate. It is also precipitated by potassium or sodium carbonate or bicarbonate and by sodium borate.

Mercurous chloride (calomel).—A precipitate of black mercurous oxide results from the addition of potassium, sodium, or calcium hydroxides to calomel. The well known "black wash" is an example of this reaction.

Mercuric iodide (*red*).—Its incompatibilities are similar to those of corrosive mercuric chloride.

Mercurous iodide (*yellow*).—Its incompatibilities are similar to those of mild mercurous chloride.

Methylthionine hydrochloride (methylene blue) is precipitated from solution by potassium iodide or potassium dichromate.

Potassium or sodium carbonates precipitate many soluble salts, producing insoluble carbonates, hydroxides, or oxides. Soluble salts of the following are so precipitated : silver, mercurous and mercuric compounds, ferrous and ferric iron, manganese, barium, strontium, calcium, tin, aluminum, chromium, antimony, lead, nickel, copper, zinc, and magnesium.

Salicylic acid and salicylates produce a precipitate with ferric salts if in nearly neutral solutions; the alkaline acetates and citrates, if present in sufficient amount, will prevent this precipitate.

Silver nitrate in aqueous solution is precipitated by the alkaline hydroxides, the alkali carbonates, the soluble chlorides, bromides, iodides, cyanides, sodium phosphate, chromates, soluble arsenites and arsenates, and by potassium permanganate if the solution is not too dilute. Tannic acid and the soluble citrates and salicylates also precipitate solutions of silver nitrate.

Sodium thiosulphate (hyposulphite) is decomposed by acids, when in aqueous solution; sulphur being precipitated and sulphur dioxide liberated.

Sulphuric acid and soluble sulphates precipitate soluble salts of lead, barium, strontium, and calcium when in sufficiently concentrated solution.

2. *Reduction of salts by chemical reaction.*—Solutions of salts of silver and of mercury furnish the best illustrations of this kind of incompatibility. Exposure to light aids in the reduction of such salts to the metallic condition. In the following prescription for an eye wash, silver chloride would be precipitated and reduction would speedily follow. If the prescription were filtered, the filtrate would contain practically no silver.

℞ Argent. Nit. gr. xxv
Sodii Chlorid. gr. xv
Aquæ f ℥ vi

The following list is appended as showing some of the more common forms of this kind of incompatibility :

Mercuric chloride (*corrosive*).—Corrosive sublimate is reduced to calomel and then to metallic mercury by metallic zinc, copper, or iron when water is present.

In alkaline mixtures the reduction occurs in the presence of the soluble arsenites, antimony and potassium tartrate, ferrous salts, and is also caused by light.

Mercurous chloride (*mild*).—Calomel is reduced to metallic mercury by nitrous compounds, as spirit of nitrous ether, and by the hypophosphites and in alkaline mixtures by arsenites and antimony and potassium tartrate.

Mercuric iodide (*red*) is reduced under conditions similar to those of corrosive mercuric chloride.

Mercuric oxide (*yellow*) is reduced by cocaine hydrochloride, forming mercuric chloride.

Mercurous iodide (*yellow*) is reduced to metallic mercury under conditions similar to those of calomel.

Silver nitrate is reduced to metallic silver by metallic zinc, copper, tin, mercury, or lead, by the soluble hypophosphites and sulphites, and in alkaline solution by arsenites, manganous and antimonous salts, and also by ferrous sulphate.

3. *Insoluble hydroxides resulting from the action of a soluble salt upon a carbonate or hydroxide.*—This form of incompatibility is common, the precipitates usually being flocculent. If the solutions are strong, they are gelatinous.

℞ Sodii Bicarbonatis ℥iiss
Potassii Sulphidi ℥ii
Sodii Chloridi ʒiv
Aluminis ʒi
Aquæ Oii
M. ft. sol.

It is impossible to produce a clear solution with the foregoing ingredients, since the sodium bicarbonate decomposes the alum, giving rise to insoluble aluminum hydroxide. The following list illustrates some of the more common incompatibilities in this class:

Adrenalin.—The addition of ammonium hydroxide or alkaline carbonates precipitates adrenalin from its solution, but it is soluble in the presence of the fixed alkalies.

Aluminum, ferric iron, chromium, and tin.—The soluble salts of the metals given are precipitated as hydroxides by potassium or sodium carbonate.

Aluminol (aluminum naphthol disulphonate) yields a precipitate of aluminum hydroxide with the alkaline hydroxides. An excess of the hydroxide renders the precipitate soluble.

Ammonia water precipitates salts of metals like the fixed alkaline hydroxides.

Cerium oxalate is slowly precipitated as an hydroxide by alkaline hydroxides.

Fixed alkaline hydroxides precipitate insoluble hydroxides or oxides when added to solutions of salts of all common metals.

4. *Precipitation of alkaloids or alkaloidal salts by alkalies, alkaline salts, general alkaloidal precipitants, or substances producing insoluble compounds.*—In all cases where prescriptions showing this kind of incompatibility are compounded, even when no signs of precipitation are visible to the compounder, a "shake" label should be pasted on the bottle so that the patient cannot take all of the poisonous alkaloid in the last dose.

This form is one of the most dangerous that is likely to be encountered. The alkaloids are very largely used, and are nearly all violent poisons; they are usually combined with acids in order to present them in forms which are soluble. Strychnine sulphate, for instance, is soluble in about 30 parts of water, while strychnine requires 6400 parts of water to dissolve it; the combination of an alkali or an alkaline salt with the strychnine sulphate precipitates the strychnine.

℞ Strychninæ Sulph. gr. i
Potassii Bromid. ʒvii
Aquæ q. s. ft. f℥viii

An inexperienced pharmacist would unhesitatingly proceed to compound the above prescription. A transparent solution would be obtained without difficulty, which would be dispensed without the slightest misgiving, but which in all probability would produce disastrous results. This solution deposits in a few hours the greater part of the strychnine salt as an insoluble bromide, which quickly subsides in transparent crystals. A lady in England lost her life by taking a similar mixture. She carefully refrained from shaking the bottle, the strychnine precipitate formed in the bottom, and in taking the last dose she swallowed nearly all of it. A similar case of dangerous chemical incompatibility occurred in the author's personal experience, the following having been prescribed by a physician who had overlooked the fact that the salts of most alkaloids are decomposed by alkaline solutions, and the alkaloids, being less soluble than the salts, are precipitated:

℞ Morph. Sulph. gr. ii
Potass. Bicarb. gr. xc
Aquæ q. s. ft. f℥ii
Sig.—Take a teaspoonful mixed with half a teaspoonful of lemon juice.

The morphine was precipitated by the alkaline carbonate, and if the bottle had not been shaken before pouring out the teaspoonful which was mixed with the lemon juice, the last dose would have contained nearly all of the morphine.

The following list shows some of the more common forms of incompatibility in this class:

Acetanilid possesses most of the incompatibilities of alkaloids.

Borates.—Sodium borate and other alkaline borates, being alkaline in reaction, may precipitate the alkaloid from a solution of its salt.

Bromides.—The soluble bromides precipitate some of the alkaloids forming insoluble compounds. This is true of strychnine, morphine, and codeine. The alkalinity of the salt may in some instances produce precipitation.

Carbonates of the alkalies precipitate many alkaloids from solutions of their salts.

Cyanides.—The alkaline cyanides may produce precipitates of an alkaloidal character from solutions of their salts.

Gold and sodium chloride is a general alkaloidal precipitant, producing insoluble double compounds with most of the alkaloids.

Hydroxides.—The fixed alkaline hydroxides as well as ammonia water precipitate free alkaloids from solutions of almost all of the salts of alkaloids.

Ichthyol.—The salts of alkaloids are precipitated from solution by ichthyol, in a resin like mass.

Iodides.—The soluble iodides form insoluble compounds with many alkaloids; the combination with strychnine is especially dangerous. Alkalinity of the salt may sometimes account for the precipitation.

Iodine is a precipitant for most of the salts of alkaloids.

Mercuric chloride is a general alkaloidal precipitant, producing insoluble compounds.

Mercuric potassium iodide (Mayer's reagent) is a well known alkaloidal precipitant, producing insoluble combinations with almost all of the alkaloids or their salts.

Potassium dichromate will precipitate many alkaloidal salts, as morphine, strychnine, quinine, atropine, codeine, and hydrastine, if their solutions are sufficiently concentrated.

Salicylates.—The soluble salicylates, when added to an aqueous solution of quinine sulphate, produce insoluble quinine salicylate.

Sodium benzoate.—Quinine sulphate when not in too dilute solution is precipitated by sodium benzoate.

Solution of arsenous and mercuric iodides (Donovan's solution) is a general alkaloidal precipitant.

Solution of lead subacetate (Goulard's extract), and *lead acetate* precipitate most of the alkaloids as well as other plant principles from their aqueous solution, forming an insoluble compound.

Solution of potassium arsenite (Fowler's solution).—The solution being alkaline from an excess of potassium bicarbonate may precipitate alkaloids.

Tannic acid forms insoluble compounds with most of the alkaloids, and some glucosides and other plant principles.

5. *Precipitation of a weak acid from its salt by the addition of a stronger acid.*—This form of incompatibility is often encountered, particularly since the prescribing of salicylates has become so general.

℞ Sodii Salicyl. gr. xl
Acid. Citric. gr. xv
Syr. Limon. f ℥ ii
Aquæ q. s. ft. f ℥ iii

Salicylic acid is only slightly soluble in water, and citric acid added to sodium salicylate will decompose the latter, and cause the salicylic acid to be thrown out as a flocculent precipitate.

Benzoates.—The soluble benzoates are decomposed when in solution by strong acids, benzoic acid separating.

Salicylates.—The mineral acids and some organic acids liberate the but slightly soluble salicylic acid when added to solutions of the soluble salicylates.

6. *Separation of a gelatinous precipitate.*—Although gelatinization in prescriptions is often the result of physical dissociation, chemical decomposition sometimes accounts for this form of incompatibility. The following list shows some illustrations :

Gambir (*catechu*), as well as many other substances containing large amounts of tannin, as *kino, krameria, hematoxylon, geranium,* and *oak bark,* produce precipitates similar to those of tannic acid.

Phenol causes a gelatinous precipitate when added to solutions of gelatin, albumin, etc.

Tannic acid will produce a precipitate when added to solutions of gelatin, albumin, gluten, or starch.

II. Evolution of a gas.—Chemical action often results in the evolution of gaseous products, and this is often intentional and desirable, as in the exhibition of effervescing solutions, but many cases occur in practice where untoward results are experienced through the ignorance of the prescriber, and sometimes explosions with serious consequences have occurred.

This kind of chemical incompatibility may be considered under the following heads :

1. Liberation of carbon dioxide by the action of a stronger acid upon a carbonate. 2. Liberation of ammonia gas by the action of an alkali or alkaline salt upon an ammonium salt. 3. Explosive compounds produced by reducing or deoxidizing agents, or as the result of chemical action. 4. Reaction between strong acids and alcoholic solutions. 5. Reaction of esters upon tannin or similar principles. 6. Production of a gas having a disagreeable odor. 7. Liberation of gases due to chemical combination not included under the preceding heads.

1. *Liberation of carbon dioxide by the action of a stronger acid upon a carbonate.*—The intentional decomposition of an alkaline carbonate

by citric, tartaric, or acetic acid is very common, and most agreeable and successful febrifuge solutions are made in this way. Unlooked-for decomposition most frequently arises from the use of the vinegars or syrups containing acetic acid in the same prescription with alkaline carbonates, the presence of the acid being generally lost sight of by the prescriber. The following is a good example :

℞ Ammon. Carb. gr. xx
Ammon. Chlor. gr. xxx
Syr. Scillæ f ℥ i
Aquæ q. s. ft. f ℥ ii
Sig.—A half-teaspoonful as required.

Explosions have occurred in compounding this prescription, when the syrup of squill has been placed in the bottle and the solutions of the ammonium salts added, and the cork inserted securely. The only way to compound it safely would be to mix the solution of the ammonium salts with the diluted syrup of squill in a mortar, and to allow all the carbonic acid gas, produced by the action of the acetic acid in the syrup on the ammonium carbonate, to escape, assisting the evolution by stirring with the pestle.

Another example is appended, showing a form of incompatibility which is very common :

℞ Phenolis gr. xxv
Sodii Bicarb.
Sodii Borat. āā ʒ i
Glycerini f ℥ i
Aquæ ad f ℥ iv

In this case the sodium borate is partially decomposed by the glycerin liberating some boric acid, which reacts upon the sodium bicarbonate, setting free carbon dioxide.

Inorganic acids, as well as *organic acids*, with the exception of hydrocyanic acid and hydrosulphuric acid (hydrogen sulphide), liberate carbon dioxide from carbonates or bicarbonates when in solution ; carbonates are also decomposed by many of the acid salts of the metals.

2. *Liberation of ammonia gas by the action of an alkali or alkaline salt upon an ammonium salt.*—This form of incompatibility in prescriptions is not very common, and the liberation of ammonia gas is often hidden, because it is absorbed by the liquid present ; but if an ammonium salt is rubbed in a mortar with a strong alkali, like sodium or potassium hydroxide, ammonia gas is at once liberated.

℞ Ammon. Chlor. ʒ ii
Potass. Bicarb. ʒ iss
Mist. Glycyrrh. Comp. f ℥ iii

In this prescription free ammonia gas can be detected by tasting, although the odor may not at first be very perceptible.

3. *Explosive compounds produced by reducing or deoxidizing agents, or as the result of chemical action.*—Incompatibility of this kind is a frequently occurring form of decomposition. Permanganates, chlorates, etc., are deoxidized by glycerin, syrup, solutions of the hypophosphites and other liquids of this character, as in the following prescription :

℞ Potass. Permang. ʒ ss
Syr. Tolut.
Aquæ āā f ℥ i

Sometimes detonating chemical compounds are produced and serious injury may occur. The following prescription looks harmless, but one well versed in chemical knowledge would scent danger :

℞ Iodi ʒii
Lin. Camph. Comp. (B.P.)
Lin. Sapon. Comp. (B.P.) āā f℥i

Compound camphor liniment of the British Pharmacopœia contains 25 percent. of strong solution of ammonia, and nitrogen iodide would be found on the filter. This is a powerful explosive.

The following list may be of service in this connection :

Adrenalin.—Being a reducing agent, is incompatible with all reducible substances.

Chromium trioxide.—When added to strong alcohol, glycerin, ether, or volatile oils, or other substances that may be easily oxidized, is apt to cause fire or explosion.

Glycerin.—When rubbed with dry oxidizing agents, as potassium permanganate, potassium chlorate, etc., is apt to cause an explosion.

Iodine may combine with oil of turpentine with sufficient force to produce an explosion.

Nitric acid.—When mixed with strong sulphuric acid and glycerin produces nitroglycerin, a powerful explosive ; it also produces explosive compounds with cotton, or other forms of cellulose, and if mixed, when concentrated, with silver or mercuric nitrate and concentrated alcohol, explosive fulminate will be formed.

Sulphuric acid.—When mixed with chlorates produces an explosion.

4. *Reaction between strong acids and alcoholic solutions.*—This form of incompatibility is not rare, and it is sometimes attended with serious results. Strong acids react upon alcohol producing ethers or esters which often have low boiling points and are easily volatilized. The following prescription caused much trouble :

℞ Tinct. Nuc. Vomicæ f℥i
Acid. Nitromur. f℥ss
Misce

The pharmacist's assistant mixed the liquids, corked the bottle securely, and handed it to the messenger, who placed the bottle in his vest pocket, and, mounting his horse, galloped away toward home. The reaction soon set in, and he soon became conscious that all was not well, for the liquid was running out of the bottle, and he thought he had broken the latter ; he returned to the pharmacy and this time the assistant used a stronger bottle and a rubber cork, which was tied down securely. On his arrival at home, the lady who was to take a few drops of the mixture, cut the string, whereupon the accumulated gaseous products forced the cork out violently, and her eye was seriously injured.

5. *Reaction of esters upon tannin or similar principles.*—Prescriptions of the kind shown below have caused much trouble and speculation ; the reaction which occurs has never been satisfactorily explained. The nitrous radical in the spirit of nitrous ether undoubtedly slowly reacts upon the tannin in the fluidextract of uva ursi, and gas accumulates, which, if confined, results in explosion. Instances are on record where prescriptions containing fluidextract of buchu (alone), with spirit of nitrous ether, have produced an explosive mixture.

℞ Ext. Buchu. Fld. f℥ii
Ext. Uvæ Ursi Fld. f℥iiiss
Spt. Ætheris Nitrosi f℥ss

Another illustration of a more complex character is appended. This liquid exploded violently five minutes after it was compounded.

℞ Quininæ Sulphat. ʒ i
Tinct. Rhei
Tinct. Capsici
Sp. Æth. Nitrosi
Liq. Arseni et Hydrarg. Iodidi
Syr. Ferri Iodidi āā f ℥ i
Spt. Frumenti
Aquæ āā f ℥ ii
Misce fiat solutio

6. *Production of a gas having a disagreeable odor.*—This form of incompatibility is occasionally met with. The disagreeable feature is one which would not be likely to lead to a repetition of the offence, for it makes a profound impression upon the patient and physician.

℞ Quininæ Sulph., gr. xl
Sodii Hyposulph. ʒ i
Acid. Sulph. Arom. f ʒ i
Aquæ q. s. ft. f ℥ iv

The acid in this prescription decomposed the sodium thiosulphate (hyposulphite), hydrogen sulphide being liberated and sulphur precipitated.

7. *Liberation of gases due to chemical combination not included under the preceding heads.*—Many illustrations of this kind of incompatibility could be furnished, but the following will show two forms of decomposition on one prescription:

℞ Aquæ Hydrogenii Diox. f ℥ ii
Potass. Permang. gr. xl
Aquæ f ℥ iv

Oxygen is liberated, both ingredients suffering in this respect. Solution of hydrogen dioxide usually contains sufficient free acid to effect decomposition. The solution will be decolorized at the same time.

The following illustrations of this form are given:

Hydrochloric acid.—When added to a chlorate liberates chlorine (see Liquor Chlori Compositus U. S. P.).

Solution of hydrogen dioxide.—Reduces potassium permanganate and is itself decomposed; if sulphuric acid is present, oxygen is freely liberated. It is also decomposed by the following, yielding oxygen: some organic substances, manganese dioxide, sodium sulphate, potassium bromide, potassium chloride, and charcoal.

III. Change in color.—Under this head may be included the following: 1. Decolorization. 2. Inky compounds resulting from the action of ferric salts upon substances containing tannin. 3. Colors changed by acids or alkalies. 4. Colored solutions produced by chemical combination with synthetic substances. 5. Colored solutions produced by chemical action not included under the preceding heads.

1. *Decolorization.*—Decolorization is not always a fault, but it usually indicates chemical decomposition. In the case of iodine preparations intended to be used externally, it may be assumed that when

decolorization results, the value of the application is reduced to "nil," as shown in *colorless tincture of iodine*, which, as usually prepared, has been shown to be a solution of ammonium iodide with other salts. The solution does not have the properties of a solution of iodine in alcohol. The following prescription illustrates this:

℞ Iodi
Sod. Hyposulph. āā ʒ iiss
Aquæ f ʒ iii
Aq. Ammon. Fort. f ʒ ii
Alcohol. q. s. ft. f ℥ iv

An instance of decolorization may be cited in which the chemical action which results forms a desirable product. If equal parts of tincture of ferric chloride and diluted phosphoric acid are mixed together, the liquid should be clear and colorless if official liquids are used. This is due to the formation of ferric phosphate which is retained in solution.

2. *Inky compounds resulting from the action of ferric salts upon substances containing tannin.*—This form of incompatibility is not of such frequent occurrence as formerly. Physicians are, as a rule, careful to avoid such combinations. The following prescription is one of the usual type:

℞ Tinct. Ferri. Chloridi f ʒ ii
Tinct. Cinchon. Comp. f ℥ ii
Tinct. Gentianæ Comp. q. s. ad f ℥ iv

Tannic acid produces a dark blue-black color with solutions of most ferric salts, the depth of color depending upon the degree of concentration. The color of a solution of ferric phosphate is not changed by tannic acid. With ferrous salts, if pure, a white, gelatinous precipitate is first produced, which rapidly becomes blue through oxidation to ferric. Usually, the ferric salt is present, and a blue colored precipitate is produced at once.

Gambir (*catechu*), *kino*, *krameria*, *oak bark*, and other drugs containing a large percentage of tannic acid may be expected to produce reactions similar to tannic acid.

3. *Colors changed by acids or alkalies.*—Surprises are sometimes experienced when liquids containing coloring matters from the animal or vegetable kingdoms are brought into contact with acids or alkalies. Compound tincture of cardamom contains cochineal, and when this is used in prescriptions containing alkalies, the color is deepened. The following prescription caused some surprise when a green color was produced instead of a red, due to the action of the alkaline salts upon the coloring matter in the infusion of rose:

℞ Magnes. Carb. ʒ i
Magnes. Sulph. ℥ i
Glycerini f ℥ ss
Infus. Rosæ Acidi ad f℥ viii

These color changes, as a rule, are harmless, but the pharmacist often has much difficulty in satisfying patients that the changes are due to causes which are natural.

4. *Colored solutions produced by chemical combination with synthetic substances.*—This is a frequent form of coloration, and the cause is usually difficult to explain, as the synthetic bodies are often complex in composition; in fact, so much complaint has been heard about

some of the color changes, when these are in solution, that many physicians prefer to always give them in substance. The following prescription has been the subject of much comment:

℞ Antipyrinæ ʒii
Spt. Æth. Nit. fʒiv
Syrupi ad f℥iv.

The green color produced is due to the formation of iso-nitroso-antipyrine. Experiments seem to show that the change does not produce poisonous compounds.

The following list shows some of these color changes:

Acetanilid.—In solution with spirit of nitrous ether produces a yellow color, changing to red in time. With tincture of ferric chloride a red color develops.

Adrenalin.—On the addition of ferric chloride to its solution an emerald-green color develops. It produces a pink color when combined with iodine. It reduces silver and gold salts in solution, producing a red liquid.

Antipyrine.—In solution with ferric chloride a red color is developed.

Resorcinol.—Solutions of resorcinol are colored violet by ferric chloride and by chlorinated lime or soda, the latter changing to yellow. Spirit of nitrous ether produces a dark red color.

Pheynl salicylate in alcoholic solution produces a violet color with ferric chloride if the latter is in dilute solution.

5. *Colored solutions produced by chemical action not included under the preceding heads.*—Prescriptions containing guaiac in solution, when brought into contact with oxidizing agents like nitric acid, spirit of nitrous ether, etc., are colored blue, or bluish-green. The following prescription for rheumatism furnishes a good example:

℞ Potass. Nit. ʒv
Vin. Colch. Rad. fʒv
Spt. Æth. Nit. f℥ii
Tr. Guaiaci f℥iii
Ol. Gaultheriæ fʒss
Aquæ q. s. ad f℥viii

The salicylates with ferric salts always have a red color:

℞ Sodii Salicylat. ℥ss
Glycerini f℥i
Ol. Gaultheriæ ♏xx
Tr. Ferri Chloridi f℥ss
Spt. Ammon. Aromat. f℥ii

The following list shows some of the more common color changes:

Hydrochloric acid gives a red to violet color with an alcoholic solution of myrrh.

Salicylic acid and salicylates, including oil of wintergreen, produce with ferric salts in solution a deep blue to violet-red color.

Aloes or aloin, in solution, is colored almost black with ferric chloride and red with spirit of nitrous ether, the intensity of color depending upon the degree of concentration.

Starch.—Starch paste is colored blue by free iodine, the depth of color depending upon the concentration. This color is dissipated by heat, but returns upon cooling.

Solution of hydrogen dioxide and phenol darkens within a few hours, the phenol being oxidized.

Creosote in alcoholic solution produces a bluish-green color with ferric chloride in alcoholic solution.

Guaiacol causes a similar color change with ferric chloride (see Creosote).

Guaiac.—The addition of oxidizing substances to an alcoholic solution of fresh guaiac resin will rapidly develop a blue color, changing to green and red; nitric acid, chromium trioxide, chlorine, potassium ferricyanide, potassium permanganate, ferric chloride, gold chloride, spirit of nitrous ether and others, will produce this effect. Mucilage of acacia also develops a blue color.

IV. Decomposition caused by chemical action producing heat.—When either iodine or bromine is added to some of the volatile oils, violent reaction, accompanied by heat, ensues; indeed, this fact has been used to detect adulterations, or prove the purity of some of the oils. The following prescription shows the effects of iodine on oil of turpentine.

℞ Iodi 5 Gm.
Alcohol 15 Cc.
Ol. Terebinth 100 Cc.

If the iodine is added to oil of turpentine, violent reaction occurs; if, however, it be dissolved in the alcohol, the solution slowly added to the oil, and the liquid cooled occasionally, the reaction is moderated.

V. Immiscible liquids formed by reaction between chemical substances.—This form is not common. The following prescription is interesting on this account:

℞ Potassii Bromid.
Chloral. Hydrat. āā ʒv
Elixir Calisayæ f℥iv

A colorless layer made its appearance on the surface after standing a short time. Prof. Markoe determined that this colorless layer in prescriptions having potassium bromide and hydrated chloral in concentrated solutions in the presence of alcohol is due to the formation of chloral alcoholate. If the bottle is not shaken before taking, an overdose of the alcoholate may be swallowed, and, though not poisonous, it is quite irritating in its action.

PHYSICAL INCOMPATIBILITY OCCURRING IN LIQUIDS

Physical incompatibility may be defined as the condition arising from the admixture of pharmaceutical preparations which results in the *physical* dissociation of one or more constituents. It differs from chemical incompatibility by the absence of *chemical* action, and is often produced by adding one liquid or substance to another, which results in the precipitation of solid matter or the separation of a portion of liquid; hence the solubilities of substances in liquids and the relative solubilities of various liquids with one another determine to a very great extent the condition of physical incompatibility.

One important consideration that must be kept in view upon the general subject is whether the separated matter is *active*, or *important*, or whether it is *inert*.

Physical incompatibility resulting in the separation of active or important constituents.

This condition is one which usually demands skilful treatment. It is seen most frequently in the precipitation produced by mixing resinous tinctures or oily liquids with aqueous liquids, or alcoholic solutions containing volatile oils, chloroform, ether, or similar substances with aqueous liquids, or by the addition of acids to solutions containing quinine with a preparation of licorice. The addition of acacia, so as to form an emulsion with the resinous tincture and the aqueous liquid, is necessary in the first case, and will be considered under the head of emulsions. Aqueous liquids mixed with alcoholic solutions containing volatile oils can usually be made transparent by filtering them through an absorbent powder like magnesium carbonate, as in the case of the medicated waters or elixirs. A frequent source of doubt arises in the case of prescriptions like the following:

For Willie.
℞ Quininæ Sulph. gr. xxx
Acid. Sulph. Dil. q. s.
Fluidextract. Glycyrrh. f ʒ ii
Syrupi, f ℥ iv
Sig.—Give a teaspoonful three times a day.

The indications are clear that this is a quinine mixture intended for a child, and that the prescriber has directed the fluidextract of licorice with the view of making it more palatable. The habit of ordering acid in connection with quinine clings to him still, and in all probability he is not aware of the fact that the sweet principle of licorice, (glycyrrhizin), is precipitated by the acid, so that the object of using the preparation of licorice is entirely defeated by the addition of the acid. Solutions of quinine should be administered either as transparent liquids when the presence of acid is relied upon to effect the solution, or as mixtures with syrups or with thick liquids containing licorice; in the latter case the object is to *prevent* solution as much as possible, and frequently a trace of solution of potassium hydroxide is added, with this end in view,—the principle being, that the smaller the quantity of *dissolved* quinine present in the liquid the less bitter will be the taste. The mixture should be thoroughly shaken before administration.

Physical incompatibility resulting in the separation of inert constituents. This condition is most frequently seen when fluidextracts are diluted with liquids which differ in composition from those used in making the fluidextract, such as alcohol, diluted alcohol, syrup, aqueous liquids, etc. The gummy, albuminous, resinous, or mucilaginous constituents are often thrown out of solution. After proving that the precipitate is inert, the remedy is simple in such cases, and filtration is all that is necessary.

With the object of classifying the different forms, the subject may be considered under the following heads: Physical incompatibility which results in I. Precipitation. II. Immiscibility. III. Incomplete solution. IV. Gelatinization. V. Cloudiness due to the separation of volatile oil from its solution in aqueous liquids.

I. Precipitation.—Under this head will be considered: 1. The separation of a precipitate due to difference in menstrua. 2. The separation of a precipitate due to difference in solvents.

1. *The separation of a precipitate due to difference in menstrua.*—This is a very frequent form of physical incompatibility. Frequently the dispenser will be required, in compounding prescriptions, to mix two or more galenical preparations which have been made by extracting drugs with alcoholic menstrua, but the strength of the alcohol has not been the same in each. In most instances some constituents will be precipitated, owing to their insolubility in the alcoholic liquid formed by the mixture of the combined liquids. The precipitate may

consist of active substances, and its character must determine the course taken by the dispenser in attempting to correct the incompatibility. Frequently the adding of small amounts of glycerin or syrup will prevent precipitation or dissolve a precipitate which may have formed; or, on the other hand, the use of mucilage of acacia or some binding agent may be indicated to uniformly suspend the separated matter.

The following examples may serve to illustrate this form:

℞ Tinct. Cannabis Ind.
Tinct. Aurantii Amar. āā f ℥ i
Tinct. Rhei f ℥ ii
Misce

In this case it will be most satisfactory to use some acacia to make a homogeneous mixture, because the resinous matter from the tincture of cannabis indica is active.

℞ Tinct. Nuc. Vomicæ, f ℥ ss
Inf. Gentianæ Comp. f ℥ iiss
Tinct. Cinchonæ Comp. f ℥ iii

In this case the precipitate is composed of inert constituents, mainly gummy and mucilaginous substances, which may be filtered out.

2. *Separation of a precipitate due to difference in solvents.*—This form furnishes constant annoyance to the pharmacist. The following prescription affords a good type:

℞ Magnes. Sulph. ℥ i
Tinct. Zingib. f ℥ i
Tinct. Aurantii Dulc. f ℥ i
Aquæ Menth. Pip. f ℥ ii

Magnesium sulphate will dissolve in peppermint water, and if the solution be poured into a bottle and the tinctures then added, a mass of crystals of magnesium sulphate will separate, due to their insolubility in alcoholic liquids. The prescription is really unfit for administration.

Mucilage of Acacia.—If alcohol or alcoholic solutions be added to this mucilage, the acacia, being insoluble, will be precipitated. Dilution with water, of either the mucilage or the alcohol, will prevent precipitation.

Alcohol.—Albumin, acacia (as has already been mentioned), and many chemical salts, in aqueous solutions, are precipitated by the addition of alcohol or alcoholic preparations, owing to their insolubility in hydro-alcoholic solution.

Water.—When alcohol has been used as the solvent for many substances, such as free alkaloids, glucosides, neutral or bitter principles, salicylic or benzoic acids, volatile oils, resins, oleoresins, balsams, or camphors, the addition of water or aqueous liquids to the alcoholic solutions will cause complete or partial separation of the dissolved substances, owing to their insolubility in hydro-alcoholic liquids; the amount of separation depending upon the degree of dilution.

II. Immiscibility.—It is impossible to expect physicians to always remember the physical characters of all solids and liquids that they desire to use in prescriptions, and the pharmacist is repeatedly called upon to harmonize discordant elements. When the intention of the prescriber can be fathomed, or when he can be consulted, a way out of the difficulty can generally be devised. No general plan can be laid down to meet all conditions. Often the addition of a little alcohol, glycerin, or water will suffice; sometimes a binding agent like acacia must be used; in every case where any important change is necessary the physician should be notified, and the dose altered to suit the case. The following metric prescription affords an illustration of a gross fault:

℞ Bromoformi 2
Syrupi 20
Aq. Foeniculi 40

In this case sufficient alcohol should be used to replace a portion of the water, or a better plan would be emulsification with mucilage of tragacanth and a little oil of almond.

III. Incomplete Solution.—Probably no form of incompatibility occurs more frequently than this, and the problem that at once presents itself is, shall the prescription be filtered, some addition made, or dispensed with a "shake label"? This question is considered upon page 1662, under the paragraph, "When to filter." The following prescription furnishes a good example:

℞ Ferri Phosph. ʒiss
Quininæ Sulph. ʒi
Strychninæ gr. i
Acid. Phos. Dil. fʒiii
Syr. Aurantii f℥ii
Spt. Frumenti q. s. ad f℥vi

Official ferric phosphate, while soluble in aqueous liquids, cannot be dissolved in alcohol, and whisky usually contains sufficient of the latter to prevent the complete solution of all of the solid ingredients in this prescription.

IV. Gelatinization.—This form of incompatibility is not rare, and very often annoys the dispenser. Mucilage of acacia is frequently used to obtund the taste of saline substances, but when used in combination with a number of solutions it forms gelatinous liquids. It has been shown that gelatinization sometimes occurs in prescriptions containing galenical preparations, due to the presence of an enzyme, as in the case of tincture of kino (see page 483). In these cases the gelatinization occurs only after the prescription has been compounded several days, and the patient may return the prescription with the statement that the liquid cannot be poured out of the bottle. The following prescription illustrates the action of sodium borate on mucilage of acacia:

℞ Sodii Brom. ʒii
Sodii Borat. ʒiii
Muc. Acaciæ f℥ii
Aq. Camph. f℥i
Aquæ q. s. ft. f℥viii.

Further illustrations are appended.

Acacia.—The mucilage is gelatinized by the solution and tincture of ferric chloride, solutions of ferric sulphate, ferric subsulphate, and iron and ammonium acetate, if they are added in concentrated form. A saturated solution of sodium borate, and solution of lead subacetate likewise produce gelatinization. If the mucilage be diluted with several volumes of water or the addition of small amounts of glycerin or syrup, gelatinization may in most instances be prevented.

V. Cloudiness due to the separation of volatile oil from its solution in aqueous liquids.—Under this head is included a form of incompatibility which is often seen. The lack of transparency in liquid prescriptions may be due to the separation of very slight precipitates of various kinds. These are considered in the previous pages, but cloudiness is often due to the separation of a volatile oil or allied product from an aromatic or medicated water, when a very soluble salt is dissolved in such waters in sufficient quantity. It must be remembered that medicated waters are intended to be saturated solutions of oils or allied products in water. The following prescription illustrates this :

℞ Potassii Brom. ʒiv
Aq. Menth. Pip. f℥i
M. ft. solutio

There would be no objection in cases of this kind to using half the quantity of the medicated water and diluting it with an equal volume of water, as it is very difficult to "filter out the cloudiness."

INCOMPATIBILITY IN SOLIDS

This subject has not been considered in the previous editions of this work under a separate head, but inasmuch as there are many forms of incompatibility in solid pharmaceutical preparations in which the problems are similar to those occurring in liquids, and as the chapters on solid extemporaneous preparations immediately follow this, it was believed that the subject should be inserted here.

Incompatibility will be considered as occurring in various forms in powders, troches, capsules, pills, suppositories, cerates, ointments, and plasters.

CHEMICAL INCOMPATIBILITY IN SOLID PREPARATIONS

This subject will be treated under the following sub-divisions: I. Chemical decomposition producing insoluble compounds. II. Evolution of a gas. III. Development of a change in color. IV. Mixtures of solids apt to explode during trituration. V. Liberation of water of crystallization due to chemical action.

I. Chemical decomposition producing insoluble compounds.—In powders this form rarely causes trouble for the pharmacist. Owing to the substances being in a dry condition, chemical action is limited. In troches and pills there may be cases in which insoluble compounds are produced, as the liquids necessary to form a mass may be in sufficient quantity to facilitate chemical decomposition. In suppositories, cerates, and ointments, the production of insoluble compounds due to chemical action is often in evidence. Judgment, skill, and experience should be used by the compounder to avert bad results; by enveloping separately the active agents in a small portion of the fatty vehicle and incorporating this with the rest of the ingredients, good results may be attained.

℞ Ichthyolis, ʒi
Morph. Sulph. gr. xii
Ac. Tannici ʒii
Ol. Theobromatis ℥iss
Fiat. suppos. No. xxiv

If moulded suppositories are made there is danger, in heating the mass, of throwing out an insoluble compound. They can, however, be made by a cold process by hand, by rubbing the ichthyol and tannic acid separately with a portion of the vehicle and mixing this with the other ingredients.

II. Evolution of a Gas.—In preparing powders where there is a liability of gas being evolved, as in the effervescent powders, care should be taken to dry the ingredients thoroughly and prevent access of moisture by using waxed paper for each powder. Ammonium salts should not be rubbed with alkaline salts, or a portion of ammonia gas will be evolved. In preparing capsules or pills, liberation of carbon dioxide may be illustrated by the following prescription :

℞ Sodii Bicarb.
Hydrarg. Chlor. Mit., āā gr. v
Ext. Rham. Pursh. gr. xv
Aloes Pulv. gr. iv
Ft. pil. No. x

The acid resins in the extract will react on the sodium bicarbonate, and cause an evolution of gas with subsequent swelling of the pills.

In suppositories, an illustration is afforded in the preparation of glycerin suppositories. If the mass is not heated gently to prevent the escape of carbon dioxide produced by the reaction between the stearic acid and sodium carbonate, the suppositories will be opaque instead of translucent. In cerates and ointments an example is furnished by citrine ointment, where, if the ointment is cooled before the reaction is completed, a porous, spongy product results.

III. Development of a change in color.—Probably the most frequent instance of this form, occurring in powders, pills, and capsules, is that of the change in color of calomel when mixed with alkaline salts and other bodies. A portion of the calomel is reduced to metallic mercury, which causes a darkening. In ointments, when potassium iodide is prescribed in combination with acids or acid salts, discoloration is due to the partial decomposition of the potassium iodide with liberation of iodine. Rancid lard, when used as a vehicle, will often cause slight decomposition of the potassium iodide and a change in color. The process for the official ointment of potassium iodide guards against darkening by using a small quantity of potassium carbonate. Unprotected steel spatulas should not be used in preparing ointments containing tannic acid, owing to the danger of producing a darkening in color in the product due to the formation of the inky ferric tannate. Steel spatulas should not be used with ointments which contain acids like citrine ointment or with any substance which acts upon iron, like iodine. The following prescription shows the reducing action of a hypophosphite upon a salt of bismuth with the production of a yellow color, passing to brown and then to black, the reaction occurring in the presence of moisture, which is almost always present in the hypophosphites :

℞ Bismuthi Subnit. ʒi
Potass. Hypophosph. ʒss
Pepsinæ, ʒi
M. fiat chart. No. xii

Yellow Mercuric Oxide.—The ointment darkens if kept for some time, due to reduction to other oxides or metallic mercury. Reducing agents rubbed with it will also produce this effect.

Red Mercuric Oxide.—Its incompatibilities in the ointment are similiar to those of the yellow oxide

Potassium hypophosphites and other hypophosphites when rubbed with calomel cause it to turn dark at once from reduction to metallic mercury. Calomel is also said to be reduced in the presence of moisture by cocaine, pilocarpine, antipyrine (especially in the presence of sugar), cane sugar, and milk sugar. It has been suggested that some mercuric chloride is formed.

IV. Mixtures of Solids apt to explode during trituration.—Many illustrations can be given of this kind of incompatibility. The trituration of substances, which readily part with oxygen, with reducing agents constitutes the most frequent cause of trouble, and serious accidents have occurred. In the compounding of powders, capsules, troches, and pills, especial watchfulness is necessary. Illustrations are appended:

℞ Potass. Chlor.
Ac. Tannici, āā ʒii
Ft. chart. No. iv

℞ Sulph. Præcip. ʒi
Argent. Oxidi gr. xii
Ft. chart. No. xii

℞ Argent. Nit. gr. xii
Creosoti gtt. xxiv
Ft. pil. No. xxiv

Explosion can sometimes be avoided or postponed by powdering each ingredient separately and mingling carefully the powders upon a piece of paper, but the dispenser, by this method, runs even a greater risk through explosion taking place at the house of the patient. The safe plan is to decline to compound such mixtures.

The following illustrates some dangerous combinations:

Chlorates.—When triturated or heated with the following substances may cause an explosion: sulphur, tannic acid, sulphides, sulphites, cyanides, hyposulphites, hypophosphites, nitrites, iodine, phenol, charcoal, sugar, honey, glycerin, and many other oxidizable substances.

Potassium cyanide, when rubbed with potassium nitrate or chlorate, is apt to produce a violent explosion.

Potassium nitrate produces readily oxidizable compounds, which may explode, if mixed with sulphur, charcoal, phosphorus, sugar, or sulphides.

Potassium Permanganate.—When triturated with readily oxidizable substances, as sulphur, the hypophosphites, charcoal, sugar, glycerin, etc., is apt to occasion an explosion.

Silver nitrate, with many organic substances, as glucose, aromatic oils, tartrate, creosote, etc., is oxidized, being changed to metallic silver, oftentimes with explosive violence.

Silver oxide produces an explosive mixture with many substances, as sulphur, tannic acid, creosote, and many organic substances.

V. Liberation of water of crystallization due to chemical action.—The development of moisture during the preparation of powders, capsules, and pills, due to the liberation of water of crystallization in one or more of the ingredients, is often an annoying form of incompatibility. The following prescription is given as an illustration:

℞ Lithii Citrat. gr. xxx
Sodii Phosph. ʒi
Ft. chart. No. x

When these salts are reduced to powder, a portion of the water of crystallization in the sodium phosphate is liberated, lithium phosphate and sodium citrate being formed as a result of the partial decomposition.

PHYSICAL INCOMPATIBILITY OCCURRING IN SOLIDS

Physical incompatibility in solid preparations may be defined as the condition arising from the admixture of medicinal substances in prescriptions, which makes the product unfit or unsuited for administration in the form prescribed by the physician. Much annoyance is often experienced by the pharmacist, caused by the ignorance of the physician as to the physical properties of the substances prescribed. Since the introduction of the flood of synthetics, the exploiters of many of the new products, recognizing the condition, issue descriptive circulars or pamphlets explaining the best methods of dispensing their wares. Judgment, skill, knowledge, and experience must all be brought into use to successfully cope with these. It is needless to say that some prescriptions must be returned to the physician for modification, but the fully equipped pharmacist may often find a means of overcoming the difficulties. It will be impossible to indicate here more than the most frequent forms. They will be considered under the following heads: I. Development of excessive moisture. II. Combinations resulting in products of a consistence unfitted for dispensing in the form prescribed. III. Immiscibility. IV. Lack of desired adhesiveness.

I. Development of excessive moisture.—This form is very annoying when powders are to be compounded, especially when the amount of developed moisture is so great as to make nearly liquid products, as in the combination of hydrated chloral and camphor. When the powders are merely damp they can be folded in waxed paper. Sometimes inert absorbent powders may be incorporated so as to permit the dispensing of the product. It is better, however, for the physician to avoid complications by directing the offending ingredient to be dispensed separately. The liberation of water of crystallization has been considered on page 1180. In making pills and capsules the development of excessive moisture can usually be offset by the addition of a "filler" of inert absorbent powder. This can also be done occasionally in the case of powders. Illustration:

℞ Phenacetin. gr. xv
Camphoræ gr. v
Phenyl. Salicyl. gr. xv
Ft. chart. No. x

Illustrations of combinations to be avoided:

Acetanilid.—When triturated with phenol, resorcinol, or thymol, a liquid or wet mass is produced; with hydrated chloral only dampness occurs.

Antipyrine, triturated with crystals of phenol, produces a liquid which is odorless and is known as phenopyrin; when rubbed with hydrated chloral, they form a liquid. A moist mass or a liquid (depending upon conditions) results from its trituration with sodium salicylate. A liquid results from its trituration with the following: acetanilide, pyrogallol, resorcinol, thymol, or ethyl carbamate.

Betanaphthol produces a damp powder or mass or a liquid when triturated with antipyrine, camphor, phenol, exalgin, menthol, or ethyl carbamate.

Camphor, menthol, resorcinol, and *phenyl salicylate* (*salol*), when rubbed with each other in about equal proportions, or when mixed with about equal weights of phenol, hydrated chloral, betanaphthol, pyrogallol, thymol, or ethyl carbamate (urethane) will produce a soft mass or liquid.

Diuretin (sodio-theobromine salicylate), when triturated with phenol or hydrated chloral, forms a liquid.

Exalgin (methyl acetanilide) produces a liquid or soft mass under conditions similar to those of camphor.

Phenacetin (acetphenetidin), when triturated with phenol or hydrated chloral, will produce a liquid.

Salicylic acid produces a damp powder or a liquid when rubbed with exalgin, lead acetate, sodium phosphate, or ethyl carbamate.

Sulphonal, when triturated with hydrated chloral, produces a liquid.

Trional, when triturated with hydrated chloral or phenyl salicylate, produces a liquid.

II. Combinations resulting in products of a consistence unfitted for dispensing in the form prescribed.—The consistence of pills, capsule masses, cerates, ointments, suppositories, or plasters, is a very important physical condition, which, if not duly taken into account, may defeat the object desired by the physician. It is necessary for the pharmacist to know, as soon as he glances at the prescription, whether the pill or capsule ordered contains too much liquid to permit incorporation so that it can be made into a pill or capsule; or whether a cerate or an ointment, when made as directed by the prescription, will be too hard or too soft; or whether a suppository will be too soft to retain its form or too hard to be of any use whatever. Lastly, a plaster may be ordered which cannot be made to adhere to the skin (see illustrations below).

℞ Ext. Ergotæ gr. xxx
Ol. Erigeron. gtt. x
Misce ft. pil. No. x

℞ Ung. Stramonii ʒ iv
Glycerit. Ac. Tannici ʒ ii
Misce ft. unguent.

℞ Gallæ pulv. ʒ ii
Opii. pulv. ʒ i
Cerati, ʒ v
Misce ft. unguent.
Use at bedtime.

℞ Ext. Opii gr. i
Phenolis gr. xxiv
Salolis ʒ ss
Ol. Theobrom. ʒ iii
Ft. suppos. No. xii

The pills can be made by using sufficient powdered althea to absorb the excess of liquid. The first ointment is fitted for a pile ointment after being softened by using a small quantity of oil of sweet almond; the second ointment will be too soft, and the physician should direct the glycerite to be replaced by tannic acid and a little glycerin; the suppository will be too soft to handle conveniently.

III. Immiscibility.—This form of incompatibility is frequently found, and considerable difficulty will be encountered in successfully dealing with it. Oil and water can be compelled to associate together through emulsification, and in making masses, suppositories, cerates, and ointments it is possible to incorporate considerable water; but prescriptions are sometimes presented which defy combination unless recourse is had to undesirable expedients.

℞ Ferri Citrat. ʒ i
Quin. Sulph. gr. xii
Ol. Carui gtt. xxx.
Misce ft. pil. No. xii

℞ Liq. Plumb. subacet. ʒ i
Petrolati ʒ iii
Misce ft. unguentum

In this pill, which is large, if sufficient "filler" is added, they become boluses, and if the ointment is compounded as directed, the liquid may be combined to pass the final inspection of the pharmacist only to be returned by the patient, for upon standing the liquids will separate.

IV. Lack of desired adhesiveness.—This kind of incompatibility is not so common as many of the previous forms. In pills and capsule masses, a little mucilage of acacia or other binding agent may be used. In suppositories, to prevent crumbling, a little bland of fixed oil may be employed. Whenever additions are made, the rule must be remembered: nothing should be used except inert substances, for the operator must not interfere with the obvious intention of the prescriber.

THERAPEUTICAL INCOMPATIBILITY

Therapeutical incompatibility may be defined as the condition arising from the combination of remedies which are mutually opposed to one another in therapeutical effect. This form of incompatibility does not often require the aid of the pharmacist. It results from an injudicious combination of remedial agents, and the correction of the fault lies solely within the province of the physician.

But some knowledge of therapeutics is necessary for the pharmacist, if he is required to recognize when he is combining agents which are antagonistic. It does not follow, of course, that the physician does not know that he is prescribing substances which are theoretically incompatible. For these reasons the pharmacist should be very careful in diagnosing a case of therapeutical incompatibility. An illustration of the combination of therapeutic antagonists is given below:

℞ Atropinæ Sulph. gr. ⅛
Morphinæ Sulph. gr. ii
Aquæ Dest. f℥ii
Misce ft. solutio
Sig.—For hypodermic use.

This prescription is frequently ordered with excellent results.

The following list is appended, with the view of offering suggestions of what should be avoided:

Aloes.—Its cathartic principle, emodin, is decomposed and rendered inert by the action of alkalies in excess.

Pepsin is rendered inactive by alkaline substances; its action is retarded in the presence of strong alcohol.

Pancreatin.—Acids destroy the activity of this enzymatic body.

Spirit of nitroglycerin is decomposed in the presence of alkalies and carbonates, forming glycerin and nitrates.

INCOMPATIBILITIES OF THE MORE IMPORTANT NEWER REMEDIES

Acetozone.—It hydrolyzes slowly when in aqueous solution, liberating oxygen. Its use depends upon this reaction and it is usually dispensed in 1 to 1000 solution. When heated or actively triturated, it decomposes.

Acetphenetidin.—When mixed with hydrated chloral, it liquefies. Strong acids or alkalies decompose it. It produces a yellow color with spirit of nitrous ether.

Adrenalin (*Epinephrine, Suprarenalin, Adnephrin, Supracapsulin*).—It is readily oxidized, becoming inert and of a pink to red color. It quickly reduces gold, silver, and mercuric salts. It is precipitated from acid solution by alkali hydroxides or carbonates. Iodine produces a pink color.

Alumnol.—It is reduced by contact with air and darkened. It is incompatible with salts of silver or other reducible salts.

Anesthesin.—It is decomposed by prolonged heating with water. Alkalies and their carbonates decompose it.

Aspirin (Acetylsalicylic Acid).—It is decomposed by water and by alkalies, producing acetic and salicylic acids or their salts. Lime water causes a precipitate of calcium acetylsalicylate. Solutions of the alkaline acetates and citrates dissolve but slowly decompose it. When in solution with salts of quinine, it has been known to develop the poisonous *quinotoxine* or *quinicine*. This occurs quickly if the solutions are heated, therefore such mixtures must not be sterilized. The salts of organic acids (acetates, citrates, and salicylates) generally produce this poisonous product when mixed with quinine. Mineral acids prevent or retard its formation.

Benzosol.—Alkalies decompose it into guaiacol and benzoic acid.

Beta-eucaine Hydrochloride.—Its aqueous solution is precipitated by alkaline hydroxides or carbonates. Mercuric chloride precipitates it from aqueous solution.

Beta-eucaine Lactate.—Incompatible with alkalies and their carbonates and with most of the alkaloidal reagents.

Betanaphthol Benzoate.—It is incompatible with antipyrine, camphor, phenol, menthol, ferric chloride, and ethyl carbamate.

Bismuth Iodosubgallate (Airol).—It is incompatible with water, liberating iodine, and with mercurous chloride. It is decomposed by alkalies and acids. Moist air decomposes it, but it may be kept in glycerin, containing a little water, without decomposition.

Bismuth Tribromphenol.—It is decomposed by alkalies, forming a bromide of the alkali. It may be heated to 120° C. (248° F.) without decomposition.

Calcium Betanaphtholsulphonate (Asaprol).—Light and air darken it and render it less soluble. Ferric chloride produces a blue color. It has the usual incompatibilities of calcium salts. It is decomposed and precipitated by mineral acids.

Chloralformamide (Chloralamide).—When mixed with antipyrine or menthol, it liquefies. Water or alkalies decompose it into hydrated chloral and formamide. It reduces silver nitrate.

Chloretone (Acetone-chloroform).—Weak acids or alkalies decompose it. It liquefies when triturated with an equal weight of phenol, menthol, antipyrine, euphorin or exalgin.

Colloidal Calomel (Calomelol).—It is precipitated from its aqueous suspension by acids.

Colloidal Mercury (Hyrgol).—It is decomposed by acids, hydroxides, and the salts of many metals. It does not precipitate albumin. It reduces mercuric chloride.

Colloidal Silver (Collargol, Cargentos).—Continued boiling causes precipitation. It is not precipitated by alkalies. Saturated solutions of sodium chloride usually act as a precipitant, but not for Cargentos, which is said to contain some casein. They should not be exposed to light or air longer than necessary, as they have the usual characteristics of silver salts.

Creosote Carbonate (Cresolal).—It is decomposed by alkaline hydroxides.

Diacetylmorphine Hydrochloride (Heroin Hydrochloride).—It is precipitated by the usual alkaloidal reagents. It is decomposed by acids or alkalies to form morphine.

Epicarin. (Betanaphtholhydroxytoluic Acid).—Exposure to air colors it red. Alkaline hydroxides and carbonates combine with it, forming, in most cases, insoluble salts.

Ethyl Carbamate (Urethane).—Strong alkali liberates ammonia. With iodine and an alkaline hydroxide or carbonate it yields iodoform.

Ethylene Diamine.—It is strongly alkaline and has the same general incompatibilities as sodium hydroxide, decomposing many metallic and alkaloidal salts.

Ethylmorphine Hydrochloride (Dionin).—It is precipitated by the usual alkaloidal reagents and by strong alkalies and carbonates.

Euquinine (Quinine Ethyl-carbonate).—Its special values depend upon its being tasteless, but acids decompose it and develop a bitter taste.

Europhen.—It is incompatible with starch, the metallic oxides, mercuric salts, and the alkaline hydroxides and carbonates. It should not be exposed to light, heat or damp air.

Ferropyrine.—It is decomposed by alkaline hydroxides, carbonates, and bicarbonates.

Gallogen (*Ellagic Acid*).—It shows the general incompatibilities of the tannins with iron salts and gelatin and is decomposed by alkalies.

Guaiamar (*Glyceryl Guaiacolate*).—It is decomposed by alkaline hydroxides and carbonates and by strong acids.

Hedonal.—It is decomposed by alkaline hydroxides, carbonates, and bicarbonates, forming methylpropylcarbinol, ammonia, and carbon dioxide.

Hexamethylenamine (*Urotropin, Formin*).—Mercuric chloride or tannic acid precipitates it from an aqueous solution. It is decomposed by hot water. Sodium salicylate, phosphate, or benzoate do not precipitate it from solution. It liquefies when rubbed with lithium carbonate or benzoate, sodium or phenyl salicylate, sodium benzoate or antipyrine. It liberates acetic acid from aspirin, followed by formaldehyde.

Holocaine Hydrochloride.—It is precipitated from solution by most of the alkaloidal reagents. The alkaline hydroxides or carbonates precipitate it from aqueous solution.

Ichthargan (*Silver Ichthyol*).—It is precipitated by soluble chlorides. It should not be exposed to light.

Ichthyol.—It is incompatible with acid and alkaline solutions, also with solutions of the carbonates and iodides, and with mercuric chloride and most alkaloidal salts.

Iodo-casein.—It is decomposed by alkalies.

Iodophenacetin (*Iodophinin*).—It is decomposed by water, iodine being liberated. Any substance having a strong affinity for iodine, such as the alkalies, will decompose it.

Lennigallol (*Pyrogallol Triacetate*).—It is incompatible with alkalies, strong acids and oxidizing agents.

Lycetol (*Dimethyl-piperazine Tartrate*).—It is incompatible with alkalies which liberate the insoluble base.

Lysidin (*Ethylene-ethenylamidine*).—Its incompatibilities are similar to ethylenediamine.

Mercuric Salicylate.—Sodium hydroxide or sodium carbonate decompose it. It is rendered soluble by chlorides, bromides, iodides, and sodium salicylate.

Neosalvarsan.—It is quickly decomposed when in contact with the air, producing dangerously poisonous compounds. Mineral acids decompose it.

Orthoform, New.—It is decomposed by heating with water. Ferric chloride produces a violet to black color. It is dissolved but decomposed by solutions of the alkaline hydroxides and carbonates. It reduces silver nitrate and other oxidizable salts.

Pancreatic Ferments (*Diazyme Essence and Glycerole, Holadin, Penase, Pankreon, Trypsin, etc.*).—They are all incompatible with strong alcohol, acids, and alkalies. They readily lose their activity when in dilute solution.

Peroxides (*Dioxides*).—The metallic peroxides liberate oxygen when in aqueous solution. Acids liberate hydrogen dioxide. They readily oxidize organic substances or salts which are readily reduced.

Phenocoll Hydrochloride.—It is decomposed by the soluble hydroxides or carbonates, precipitating the base. It is precipitated by most alkaloidal reagents. It reduces gold or silver salts.

Phenocoll Salicylate (*Salocoll*).—It has the usual incompatibilities of the salicylates. It liquefies when triturated with hydrated chloral.

Piperazine.—Being strongly alkaline, it is incompatible with acetanilid, acetphenetidin, most alkaloidal salts, nitrites, metallic salts generally, and with picric and tannic acids. It reduces silver nitrate and other readily oxidizable salts. It produces a liquid or soft mass when triturated with hydrated chloral, acetanilid, phenol, acetphenetidin, and antipyrine.

Pyramidon (*Dimethylaminoantipyrine*).—Its incompatibilities are similar to those of antipyrine; oxidizing solutions and acacia produce colored solutions.

Quinine and Urea Hydrochloride.—It is decomposed by the soluble alkaline hydroxides, alkaloidal quinine being precipitated.

Saliformin (*Hexamethylenamine Salicylate*).—It is decomposed by alkaline hydroxides, carbonates, and by strong acids. It shows the general incompatibilities of the salicylates.

Salipyrine (*Antipyrine Salicylate*).—It is incompatible with acids, alkalies, and tannins.

Salophen.—The alkaline hydroxides decompose it.

Saloquinine (*Quinine Salicylic Ester*).—It is precipitated from acid solution by most alkaloidal reagents. Ferric chloride colors its alcoholic solution reddish-violet.

Salvarsan (*"606"*).—It is quickly decomposed in the air, producing arsenic compounds which are much more poisonous. Alkaline hydroxides or carbonates precipitate the base from an acid solution. It is not decomposed by acids.

Sidonal (*Piperazine Quinate*).—It shows the general incompatibilities of alkaloids.

Silver Casein (*Argonin*).—Its aqueous solution is precipitated by acids, but it is soluble in the presence of alkalies and sodium chloride. It is not affected by the usual silver reagents. It is precipitated by lead acetate, mercuric chloride, ferric chloride, zinc sulphate, phenol, alum, and tannic acid.

Silver Protein (*Protargol*).—It is precipitated by most metallic salts, also by picric acid. It is decomposed by light and air and should be protected. Cocaine hydrochloride causes a precipitate which may be prevented by the addition of boric acid.

Silver Vitellin (*Argyrol*).—It yields a slight precipitate of silver chloride with sodium chloride or hydrochloric acid. It is incompatible with acids, most of the neutral or acid salts, and with alcohol, forming a precipitate. Mercuric chloride and ferric chloride decolorize it and produce a white precipitate. It is not precipitated by albumin or alkalies.

Theobromine Sodio-salicylate (*Diuretin*).—It is decomposed by acids, when in solution, theobromine and salicylic acid both being precipitated. It reduces salts of silver and mercury. Being alkaline, it shows the general incompatibilities of alkalies, also of theobromine and of salicylates.

Stovaine.—It is precipitated by the usual alkaloidal reagents. Even weak alkali decomposes it. Heat, even a boiling temperature, does not decompose it.

Styracol (*Guaiacol Cinnamate*).—It is decomposed by alkaline hydroxides.

Sublamine (*Mercuric Sulphate, Ethylenediamine*).—It should not be exposed to the air. It is incompatible with sodium chloride.

Sulphonethylmethane (*Trional*).—It forms a soft mass when triturated with thymol, urethane, phenyl salicylate, and hydrated chloral.

Sulphonmethane (*Sulphonal*).—It is very stable, not being decomposed by acids, alkalies, or oxidizing agents. Rubbed with hydrated chloral, it liquefies.

Tannalbin (*Albumin Tannate*).—It is decomposed by alkalies.

Tannigen (*Diacetyl Tannin*).—It is decomposed by alkalies and salts of iron. It should not be exposed to heat or moisture.

Tannopin.—It is decomposed by alkalies.

Theobromine Sodio-acetate.—It is decomposed by most of the alkaloidal reagents, and by carbonated beverages, acids, and saccharine and mucilaginous liquids.

Thigenol (*Sodium Sulpho-oleate*).—It is incompatible with mineral acids and also with acetic acid.

Tropacocaine Hydrochloride.—It shows the general incompatibilities of alkaloids.

Validol (*Methyl Valerate*).—It is decomposed by alkalies.

Veronal (*Diethyl-barbituric Acid*).—When heated with sodium carbonate, ammonia is liberated. It darkens calomel when triturated with it.

QUESTIONS ON INCOMPATIBILITY

What four conditions may produce incompatibility in pharmaceutical mixtures? (See page 1675.)

Into what three classes may incompatibility be conveniently divided?

What is meant by chemical imcompatibility?

Precipitation—Give an illustration showing an intentional production of a precipitate. How should such a prescription be dispensed?

Give an illustration in which a precipitate is not desired. How should such a prescription be dispensed?

Give an illustration of a precipitate resulting from the mixing of salts which, of themselves, are soluble but form an insoluble salt.

Mention a number of substances which will produce such precipitates.

Illustrate the production of an insoluble precipitate through the reduction of a salt.

Under what circumstances will an insoluble hydroxide be formed in a prescription?

Enumerate the conditions which will cause the precipitation of alkaloidal substances.
Give an illustration of the precipitation of a weak, insoluble acid.
Liberation of a gas—Under what conditions is the evolution of a gas, in a prescription, desirable?
What is the possible danger when a gas is liberated in a tightly stoppered bottle?
Give an illustration of a prescription in which carbon-dioxide is liberated unintentionally.
To what is the liberation of carbon-dioxide due in a mixture containing phenol, sodium bicarbonate, sodium borate, glycerin and water?
Under what conditions may ammonia gas be liberated?
Give an illustration of an explosion due to a reducing agent.
How do strong acids act upon alcoholic liquids?
What is the result at times when tannin-like substances are mixed with spirit of nitrous ether?
What substances, when decomposed, liberate disagreeable odors?
What substances will decompose solution of hydrogen dioxide, liberating oxygen?
Change in color—Give an illustration of decolorization which indicates that the preparation no longer possesses its original medicinal value.
Cite an instance in which a colorless compound is formed, of value equal to the original colored substance.
To what cause may the production of an inky color usually be attributed?
Give illustrations of some surprising changes in color caused by acids or alkalies acting upon organic substances.
Mention some of the color changes which may result with combinations of the following synthetics: Acetanilid; antipyrine; resorcinol; phenyl salicylate.
Mention other changes in color resulting from chemical action.
Production of heat—Enumerate instances in which this phenomenon may occur.
Immiscible liquids formed by chemical reaction—Cite instances illustrating this incompatibility. What is meant by physical incompatibility?
In instances where the active constituents separate how may the skill of the dispenser overcome the difficulty? Mention specific cases.
If the separated matter is proven to be inert what should be the remedy?
Give illustrations of the separation of a precipitate due to a difference in menstrua.
Of a precipitate due to a difference in solvents.
When substances, prescribed together, are immiscible, what general rules should govern the dispenser?
When substances are not completely soluble what shall determine his course?
Give instances in which gelatinization may occur.
Under what circumstances may volatile oils separate from solution?
Incompatibility in solid preparations—Enumerate instances in which a chemical change produces an insoluble substance.
What combinations of solid substances will produce the evolution of a gas?
Mention changes of color which may occur in various solid preparations, as powders, ointments and capsuls.
Enumerate substances which may cause explosions when rubbed with reducing agents.
Under what conditions do powders sometimes become moist or turn to a liquid, due to chemical action?
When may this same result be due to a physical change simply?
Mention a number of substances which liquefy when rubbed together.
How may such difficulties be remedied?
If the resulting combination, as prescribed, is unfitted in consistence for dispensing, what rule should the compounder follow?
Mention substances, prescribed for dispensing in the form of solids, which are immiscible.
What may sometimes remedy this difficulty?
What is meant by therapeutical incompatibility? Give examples.
Enumerate some of the more important incompatibilities experienced with the "newer remedies."

CHAPTER LXVII

SOLID EXTEMPORANEOUS PREPARATIONS

Powders, Cachets, Troches, Pills, and Suppositories

Pulveres *Powders*

POWDERS often furnish a convenient and agreeable mode of administering medicines which are not bitter, nauseous, or otherwise offensive to the taste, are not corrosive, nor deliquescent, nor given in large doses. Pulverization facilitates the solution or the extraction of the soluble principles of a substance by extending the surface exposed to the action of the solvent. (See Comminution, page 189.) With the view of establishing a standard and encouraging uniform practice in prescribing certain forms of powders which have become well known, a limited number of compound powders have been admitted to the Pharmacopœia. The following tables give in a condensed form the processes for official and some unofficial powders, and immediately after these will be found the working formulas.

U. S. P. Powders

Pulvis Aromaticus	Made by triturating 15 Gm. each of Cardamom Seed (freed from the pericarps) and Myristica, in coarse powder, with a portion of the 35 Gm. of Saigon Cinnamon, until the whole is finely powdered, then adding the remainder of the Saigon Cinnamon and 35 Gm. of powdered Jamaica Ginger and thoroughly mixing
Cretæ Compositus	Made by intimately mixing 30 Gm. of Prepared Chalk, 20 Gm. of powdered Acacia, and 50 Gm. of powdered Sugar
Effervescens Compositus	Made by intimately mixing 30 Gm. of Sodium Bicarbonate and 90 Gm. of Potassium and Sodium Tartrate, dividing the mixture into 12 equal parts and wrapping each part in a separate blue paper, then dividing 26 Gm. of Tartaric Acid into 12 equal parts and wrapping each in a separate white paper. All powders should be dry and finely powdered
Glycyrrhizæ Compositus	Made by thoroughly triturating 4 Gm. of Oil of Fennel with 250 Gm. of powdered Sugar, then adding 250 Gm. more of the Sugar, 180 Gm. of powdered Senna, 236 Gm. of powdered Glycyrrhiza, and 80 Gm. of Washed Sulphur, and mixing the whole intimately
Ipecacuanhæ et Opii	Made by finely powdering and intimately mixing 10 Gm. of Ipecac, 10 Gm. of Powdered Opium, and 80 Gm. of Sugar of Milk
Jalapæ Compositus	Made by thoroughly mixing 35 Gm. of powdered Jalap and 65 Gm. of powdered Potassium Bitartrate
Rhei Compositus	Made by thoroughly mixing 25 Gm. of powdered Rhubarb, 65 Gm. of Magnesium Oxide, and 10 Gm. of powdered Jamaica Ginger

N. F. Powders

Pulvis Acetanilidi Compositus	Made by powdering and thoroughly mixing 70 Gm. of Acetanilid, 10 Gm. of Caffeine, and 20 Gm. of Sodium Bicarbonate
Aloes et Canellæ	Made by intimately mixing 80 Gm. of Aloes and 20 Gm. of Canella in fine powder
Antimonialis	Made by intimately mixing 33 Gm. of Antimony Oxide and 67 Gm. of Precipitated Calcium Phosphate
Antisepticus	Made by triturating 5 Gm. Salicylic Acid and 125 Gm. of Zinc Sulphate together until a fine powder results, add 1 Gm. each of Phenol, Menthol, Eucalyptol and Thymol, previously liquefied by trituration, then add the Boric Acid in successive portions, continuing the trituration until a uniform powder results. Finally pass the powder through a No. 80 sieve
Aromaticus Rubefaciens	Made by mixing thoroughly 30 Gm. each of powdered Clove and powdered Saigon Cinnamon and 20 Gm. each of Jamaica Ginger and powdered Capsicum. The product should be kept in a tightly closed container

N. F. Powders—*Continued*

Pulvis Cretæ Aromaticus	Made by mixing 8 Gm. of Saigon Cinnamon, 6 Gm. of Myristica, 3 Gm. of Clove, 2 Gm. of Cardamon Seed, 25 Gm. of Prepared Chalk and 56 Gm. of Sugar and reducing them to a fine powder
Cretæ et Opii Aromaticus	Made by intimately mixing 97.5 Gm. of Aromatic Chalk Powder and 2.5 Gm. of powdered Opium
Gambir Compositus	Made by mixing 40 Gm. of Gambir, 20 Gm. each of Kino and Krameria and 10 Gm. each of Saigon Cinnamon and Myristica all in fine powder and passing through a fine sieve
Hydrargyri Chloridi Mitis et Jalapæ	Made by intimately mixing 34 Gm. of Mild Mercurous Chloride and 66 Gm. of Jalap
Kino et Opii Compositus	Made by mixing 75 Gm. of Kino, 5 Gm. of powdered Opium, and 20 Gm. of Saigon Cinnamon and passing through a fine sieve
Myricæ Compositus	Made by reducing 60 Gm. of Bayberry Bark, 30 Gm. of Jamaica Ginger, and 5 Gm. each of Capsicum and Clove to a moderately fine powder and mixing them
Pancreatini Compositus	Made by mixing 20 Gm. of Pancreatin and 80 Gm. of Sodium Bicarbonate with trituration
Rhei et Magnesiæ Anisatus	Made by mixing 35 Gm. of Rhubarb, 65 Gm. of Heavy Magnesium Oxide and adding 8 mils of Anethol, previously dissolved in 10 mils of alcohol, and triturating until a uniform mixture results
Talci Compositus	Made by mixing 30 Gm. of Salicylic Acid and 100 Gm. of Boric Acid and adding 870 Gm. of Talc in successive portions, mixing thoroughly by trituration

Unofficial Powders

Name	Ingredients	Preparation
Pulvis Amygdalæ Compositus. Br.	60 Gm. Sweet Almonds; 30 Gm. powdered Sugar; 10 Gm. powdered Gum Acacia	Blanch the Almonds, dry them thoroughly with the aid of a gentle heat, then triturate them in a mortar to a smooth paste, add the Gum Acacia and Sugar, and rub the whole to a uniformly coarse powder
Buteæ Seminum	Butea Seed	Soak Butea Seed in distilled water; carefully remove the integuments; dry and powder the kernels
Catechu Compositus. Br.	40 Gm. powdered Catechu; 20 Gm. powdered Kino; 20 Gm. powdered Krameria Root; 10 Gm. powdered Cinnamon Bark; 10 Gm. powdered Nutmeg	Mix them
Cinnamomi Compositus Br.	25 Gm. each of powdered Cinnamon Bark, Cardamon Seed, and Ginger	Mix them
Elaterini Compositus. Br. 1898	1 Gm. Elaterin; 39 Gm. Milk Sugar	Triturate them, in a mortar, until a fine powder is produced
Kaladanæ Compositus Br.	30 Gm. of Kaladana; 60 Gm. of Acid Potassium Tartrate, and 10 Gm. of Ginger	Mix them
Morphinæ Compositus. U. S. P. VIII	1.5 Gm. Morphine Sulphate; 33.5 Gm. Precipitated Calcium Carbonate, 32 Gm. of Camphor and 33 Gm. of Powdered Glycyrrhiza	Mix the Morphine Sulphate intimately with the Precipitated Calcium Carbonate and add the Camphor, previously powdered with a little alcohol, triturate thoroughly, add the powdered Glycyrrhiza and mix
Opii Compositus. Br.	30 Gm. Opium; 40 Gm. Black Pepper; 100 Gm. Ginger; 120 Gm. Caraway Fruit; 10 Gm. Tragacanth, all in powder	Mix them
Scammoniæ Compositus. Br.	50 Gm. Scammony Resin; 35 Gm. Jalap; 15 Gm. Ginger, all in powder	Mix them
Tragacanthæ Compositus. Br.	15 Gm. Tragacanth; 20 Gm. Gum Acacia; 20 Gm. Starch; 45 Gm. Sugar, all in powder	Mix them

PULVIS AROMATICUS. U. S. Aromatic Powder

[Pulv. Arom.]

	Metric	Old form
***Saigon Cinnamon**, in No. 60 powder	35 Gm.	7 oz. av.
Jamaica Ginger, in No. 60 powder	35 Gm.	7 zo. av.
Cardamom Seed (deprived of pericarps)	15 Gm.	3 oz. av.
Myristica, freshly grated	15 Gm.	3 oz. av.
To make	100 Gm.	20 oz. av.

Triturate the cardamom seed and the myristica with a portion of the saigon cinnamon until they are reduced to a fine powder; then add the remainder of the cinnamon and the ginger and rub them together until they are thoroughly mixed.

Official Description.—Light reddish-brown; with a strong, distinctive, aromatic odor.

Tests for Identity and Purity.—When examined under the microscope it exhibits characteristic starch grains of ginger, being elliposoidal or ovoid, slightly beaked and from 0.005 to 0.06 mm. in diameter; numerous yellowish-brown, brownish-red and occasional blackish fragments, the cellular structure of which is not distinct; occasional stone cells, the lamina being filled usually with a reddish-brown amorphous substance or containing air; occasional fragments with sclerenchymatous fibers; calcium oxalate crystals, in short rhaphides, few.

U. S. P. Preparation.—Fluidextractum Aromaticum.

N. F. Preparations.—Pilulæ Aloes et Ferri; Pilulæ Aloes et Myrrhæ.

Average Dose.—Fifteen grains (1 Gm.).

PULVIS CRETÆ COMPOSITUS. U. S. Compound Chalk Powder

[Pulv. Cret. Co.]

	Metric	Old form
***Prepared Chalk**	**30 Gm.**	1½ oz. av.
Acacia, in fine powder	**20 Gm.**	1 oz. av.
Sugar, in fine powder	**50 Gm.**	2½ oz. av.
To make	**100 Gm.**	5 oz. av.

Mix the powders intimately by trituration and pass the product through a No. 60 sieve.

U. S. P. Preparation.—Mistura Cretæ.

Average Dose.—Thirty grains (2 Gm.).

PULVIS EFFERVESCENS COMPOSITUS. U. S. Compound Effervescing Powder

[Pulv. Eff. Co.—Seidlitz Powder]

The weight of the mixture in a blue paper is not less than 9.5 Gm. nor more than 10.5 Gm.; it contains not less than 23 per cent. nor more than 27 per cent. of sodium bicarbonate and not less than 73 per cent. nor more than 78 per cent. of potassium and sodium tartrate.

	Metric	Old form
***Sodium Bicarbonate,** dried and in fine powder	**30 Gm.**	1 oz. av. 26 gr.
Potassium and Sodium Tartrate, dried and in fine powder	**90 Gm.**	3 oz. av. 76 gr.
Tartaric Acid, dried and in fine powder	**26 Gm.**	401 gr.

Mix the sodium bicarbonate intimately with the potassium and sodium tartrate, divide the mixture into *twelve equal parts,* and wrap each part in a separate blue paper.

Then divide the tartaric acid into *twelve equal parts,* and wrap each part in a separate white paper.

Keep the powders in well-closed containers, in a dry place.

Test for Identity.—To 5 mils of an aqueous solution of the mixture in a blue paper (1 in 20) add 5 mils of acetic acid, and when effervescence has ceased, shake the solution vigorously; a white crystalline precipitate, soluble in ammonia water, separates.

Assay for Sodium Bicarbonate.—Mix thoroughly the contents of a blue paper, then dissolve 2 Gm. of it in 80 mils of distilled water, add 20 mils of half-normal sulphuric acid V.S., boil the solution until the volume is reduced to about 50 mils, and titrate the excess of acid with half-normal potassium hydroxide V.S., phenolphthalein T.S. being used as indicator. The number of mils of half-normal sulphuric acid V.S. consumed shows not less than 23 per cent. nor more than 27 per cent. of sodium bicarbonate.

Each mil of half-normal sulphuric acid V.S. corresponds to 0.04200 Gm. of sodium bicarbonate. Each gramme of the mixture corresponds to not less than 5.48 mils nor more than 6.43 mils of half-normal sulphuric acid V.S.

Assay for Potassium and Sodium Tartrate.—Proceed as directed under the assay for alkali salts of organic acids (see U. S. P., Test No. 6, Chapter LXII), using 2 Gm. of the mixture taken from the blue paper used in the preceding assay. The difference between the number of mils of half-normal sulphuric acid V.S. consumed in this assay and in the assay for sodium bicarbonate, multiplied by 0.07055, represents the potassium and sodium tartrate, and corresponds to not less than 73 per cent. nor more than 78 per cent.

The sum of the percentages of sodium bicarbonate and of the potassium and sodium tartrate is not less than 99 per cent.

These powders are aperient and refrigerant.

Average Dose.—One set of two powders.

PULVIS GLYCYRRHIZÆ COMPOSITUS. U. S. Compound Powder of Glycyrrhiza

[Pulv. Glycyrrh. Co.—Compound Licorice Powder.]

	Metric	Old form
***Senna,** in No. 80 powder	**180 Gm.**	315 gr.
Glycyrrhiza, in No. 80 powder	**236 Gm.**	413 gr.
Washed Sulphur	**80 Gm.**	140 gr.
Oil of Fennel	**4 Gm.**	5 min.
Sugar, in fine powder	**500 Gm.**	2 oz. av.
To make	**1000 Gm.**	4 oz. av.

Mix the oil of fennel thoroughly with about one-half of the sugar, then add the remainder of the sugar and the other ingredients, and mix thoroughly. Finally, pass the powder through a No. 80 sieve, pulverize the residue, if any should be left on the sieve, add it to the sifted powder, and mix thoroughly. Keep it in well-closed containers.

Official Description.—Greenish-yellow to greenish-brown with a fennel-like odor.

Tests for Identity and Purity.—When mounted in water or hydrated chloral T.S. and examined under the microscope, Compound Powder of Glycyrrhiza shows fragments of glycyrrhiza with their characteristic yellow fibers associated with crystal fibers, large tracheæ with elliptical, bordered pores and cells containing numerous, spherical starch grains varying from 0.002 to 0.02 mm. in diameter, also fragments of senna as shown by their characteristic, more or less, bent, unicellular, non-glandular hairs, from 0.1 to 0.35 mm. in length; fragments of epidermis with elliptical stomata and their 2 neighboring cells and fragments with crystal fibers; upon the addition of potassium hydroxide T.S. to aqueous mounts of the powder, some of the fragments are immediately colored a yellowish-red, changing to a reddish-brown.

Introduce 0.1 Gm. of Compound Powder of Glycyrrhiza into a test tube, moisten it with 2 mils of alcohol, then add 10 mils of water, boil the mixture, allow it to cool and then filter; the filtrate is of a pale yellowish-brown color, which changes immediately to a yellowish-red on the addition of a drop of potassium hydroxide T.S.

Compound Powder of Glycyrrhiza is free from an odor of hydrogen sulphide.

This powder is an agreeable laxative.

Average Dose.—Sixty grains (4 Gm.).

PULVIS IPECACUANHÆ ET OPII. U S. Powder of Ipecac and Opium

[**Pulv. Ipecac. et Opii.**—Compound Powder of Ipecac. Dover's Powder Opii et Ipecacuanhæ pulvis compositus **P. I.**]

	Metric	Old form
***Ipecac,** in No. 60 powder	**10 Gm.**	175 gr.
Powdered Opium	**10 Gm.**	175 gr.
Sugar of Milk, in No. 30 powder	**80 Gm.**	3 oz. av. 87½ gr.
To make	**100 Gm.**	4 oz. av.

Triturate these together thoroughly until the mixture is reduced to a very fine, uniform powder.

Official Description.—Grayish-white or very light brown.

Tests for Identity and Purity.—Under the microscope it exhibits coarse, angular, frequently more or less cone-shaped, colorless fragments from 0.03 to 0.4 mm. in length, very slowly soluble in water and hydrated chloral T.S. and strongly polarizing light with a strong display of colors (fragments of *sugar of milk*); numerous starch grains of ipecac, their presence confirmed by the addition of iodine T.S., and varying from 0.003 to 0.017 mm. in diameter; occasional fragments of tracheids of ipecac; and occasional fragments with the more or less tabular, characteristic stone cells of the capsules of the opium poppy, with their light brown, porous and strongly lignified walls.

This powder is anodyne and diaphoretic.

Average Dose.—Eight grains (0.5 Gm.).

PULVIS JALAPÆ COMPOSITUS. U. S. Compound Powder of Jalap

[**Pulv. Jalap. Co.**—Pulvis Purgans]

	Metric	Old form
***Jalap,** in No. 60 powder	**35 Gm.**	1 oz.av. 175½ gr.
Potassium Bitartrate, in fine powder	**65 Gm.**	2 oz.av. 262 gr.
To make	**100 Gm.**	4 oz. av.

Mix the powders intimately by trituration and pass the product through a No. 60 sieve.

Official Description.—Very light brown.

Tests for Identity and Purity.—When examined under a microscope it exhibits numerous sharp-angular, colorless fragments mostly somewhat rectangular and with straight edges varying from 0.03 to 0.3 mm. in length, slowly soluble in water or hydrated chloral T.S. and strongly polarizing light with a strong display of colors (fragments of crystals of *potassium bitartrate*); numerous starch grains of jalap, readily distinguished without the use of iodine T.S., usually single, occasionally 2- to 3-compound, and varying from 0.003 to 0.035 mm. in diameter; occasional fragments of laticiferous vessels and parenchyma with yellowish-brown walls, or tracheæ with bordered pores, and rosette aggregates of calcium oxalate from 0.01 to 0.035 mm. in diameter, that occur in jalap.

Compound Powder of Jalap is a hydragogue cathartic.

Average Dose.—Thirty grains (2 Gm.).

PULVIS RHEI COMPOSITUS. U. S. Compound Powder of Rhubarb

[**Pulv. Rhei Co.**—Gregory's Powder]

	Metric	Old form
***Rhubarb,** in No. 60 powder	**25 Gm.**	1 oz. av.
Magnesium Oxide	**65 Gm.**	2 oz. av. 262 gr.
Jamaica Ginger, in No. 60 powder	**10 Gm.**	175½ gr.
To make	**100 Gm.**	4 oz. av.

Rub the rhubarb and ginger together, then gradually add the magnesium oxide and continue the trituration until they are thoroughly mixed, then pass through a No. 60 sieve.

Official Desoription.—A pinkish-white, mobile powder, becoming darker on exposure to moisture.

Tests for Identity and Purity.—When examined under the microscope it exhibits fine particles of magnesium oxide, numerous starch grains and characteristic fragments of vegetable tissues; starch grains of ginger, more or less elliptical or ovoid, frequently with a prominent beak, from 0.005 to 0.06 mm. in diameter; starch grains of rhubarb, single or compound, either spherical or polygonal, often with a central cleft, from 0.002 to 0.02 mm. in diameter; mounts made with hydrated chloral T.S. give a strong effervescence and show more clearly the fragments of reticulate tracheæ, the reddish-brown parenchyma of rhubarb with numerous small starch grains or rosette aggregates of calcium oxalate, varying from 0.05 to 0.1 mm. in diameter. With solutions of the alkalies many of the fragments of rhubarb become of a deep red color.

This powder is used as a laxative and antacid.

Average Dose.—Thirty grains (2 Gm.).

PULVIS ACETANILIDI COMPOSITUS. N. F. Compound Acetanilid Powder

(U. S. P. VIII)

[Pulv. Acetan. Co.]

	Metric	Old form
Acetanilid	70 Gm.	2 oz. av. 350 gr.
Caffeine	10 Gm	175 gr.
Sodium Bicarbonate	20 Gm.	350 gr.
To make	100 Gm.	4 oz. av.

Reduce the ingredients to a fine powder and mix them thoroughly.

This powder is used as an analgesic, often in the treatment of headaches.

Average Dose.—5 grains (0.32 Gm.).

PULVIS ALOES ET CANELLÆ. N. F. Powder of Aloes and Canella

[Pulv. Aloe. et Canell.—HIERA PICRA]

	Metric	Old form
Aloes, in fine powder	80 Gm.	3 oz. av. 87½ gr.
Canella, in fine powder	20 Gm.	350 gr
To make	100 Gm.	4 oz. av.

Mix the powders intimately.

This is used as a laxative but is rarely employed to-day. It has gained some reputation as an abortifacient and therefore must be sold with caution.

Average Dose.—5 grains (0.32 Gm.).

PULVIS ANTIMONIALIS. N. F. Antimonial Powder

[Pulv. Antimon.—JAMES' POWDER]

	Metric	Old form
Antimony Oxide	33 Gm.	1 oz. av. 140 gr.
Precipitated Calcium Phosphate	67 Gm.	2 oz. av. 297½ gr.
To make	100 Gm.	4 oz. av.

Mix the powders intimately.

James' powder has been used as a diaphoretic but in large doses becomes emetic and purgative.

Average Dose.—3 grains (0.2 Gm.).

PULVIS ANTISEPTICUS. N. F. Soluble Antiseptic Powder

[**Pulv. Antisept.**—PULVIS ANTISEPTICUS SOLUBILIS]

	Metric	Old form
Salicylic Acid	5 Gm.	70 gr.
Phenol	1 Gm.	14 gr.
Eucalyptol	1 Gm.	14 gr.
Menthol	1 Gm.	14 gr.
Thymol	1 Gm.	14 gr.
Zinc Sulphate	125 Gm.	4 oz. av.
Boric Acid, in impalpable powder	866 Gm.	27 oz. av. 311 gr.
To make	1000 Gm.	32 oz. av.

Triturate the salicylic acid and zinc sulphate to a very fine powder, add the phenol, eucalyptol, menthol, and thymol, previously liquefied by trituration, and continue the trituration, adding the boric acid, in small portions at a time, until a uniform, fine powder is obtained. Finally pass the powder through a No. 80 sieve. It is used as an antiseptic dusting powder.

PULVIS AROMATICUS RUBEFACIENS. N. F. Rubefacient Spice Powder

[**Pulv. Arom. Rubefac.**—REPLACING EMPLASTRUM AROMATICUM N.F. III]

	Metric	Old form
Clove, in No. 40 powder	30 Gm.	1 oz. av. 87½ gr.
Saigon Cinnamon, in No. 60 powder	30 Gm.	1 oz. av. 87½ gr.
Jamaica Ginger, in No. 40 powder	20 Gm.	350 gr.
Capsicum, in No. 40 powder	20 Gm.	350 gr.
To make	100 Gm.	4 oz. av.

Mix the powders thoroughly and keep the product in a tightly-closed container. This powder has been introduced for the purpose of making *Spice Poultice.* The required quantity should be placed in a flat muslin bag and moistened with either diluted alcohol, whisky, or vinegar, previously heated.

PULVIS CRETÆ AROMATICUS. N. F. Aromatic Powder of Chalk

[**Pulv. Cret. Arom.**]

	Metric	Old form
Saigon Cinnamon	8 Gm.	140 gr.
Myristica	6 Gm.	105 gr.
Clove	3 Gm.	52 gr.
Cardamom Seed	2 Gm.	35 gr.
Prepared Chalk	25 Gm.	1 oz. av.
Sugar	56 Gm.	2 oz. av. 105 gr.
To make	100 Gm.	4 oz. av.

Mix the ingredients and reduce them to a fine powder. Pass this through a fine sieve, and afterwards rub it lightly in a mortar. Keep it in a stoppered bottle. This powder combines the carminative effects of the aromatic with the antiacid chalk and is employed in diarrhœa involving superacidity.

Average Dose.—Thirty grains (2 Gm.).

PULVIS CRETÆ ET OPII AROMATICUS. N. F. Aromatic Powder of Chalk and Opium

[**Pulv. Cret. et Opii Arom.**]

	Metric	Old form
Aromatic Powder of Chalk	97.5 Gm.	3 oz. av. 394 gr.
Powdered Opium	2.5 Gm.	44 gr.
To make	100 Gm.	4 oz. av.

Mix the powders intimately. In this preparation the narcotic effect of opium is added to the aromatic chalk powder. It is used when the diarrhœa is accompanied with much pain.

Average Dose.—Fifteen grains (1 Gm.).

PULVIS GAMBIR COMPOSITUS. N. F. Compound Powder of Gambir

[Pulv. Gambir Co.—Pulvis Catechu Compositus N.F. III]

	Metric	Old form
Gambir, in fine powder	40 Gm.	1 oz. av. 262 gr.
Kino, in fine powder	20 Gm.	350 gr.
Krameria, in fine powder	20 Gm.	350 gr.
Saigon Cinnamon, in fine powder	10 Gm.	175 gr.
Myristica, in fine powder	10 Gm.	175 gr.
To make	100 Gm.	4 oz. av.

Mix the powders intimately, pass the mixture through a fine sieve, and afterwards rub it lightly in a mortar. Keep it in a stoppered bottle. It is used in diarrhœa largely for its astringency.

Average Dose.—Twenty grains (1.3 Gm.).

PULVIS HYDRARGYRI CHLORIDI MITIS ET JALAPÆ. N. F. Powder of Mild Mercurous Chloride and Jalap

[Pulv. Hydrarg. Chlor. Mit. et Jalap.—Calomel and Jalap]

	Metric	Old form
Mild Mercurous Chloride	34 Gm.	1 oz. av. 157 gr.
Jalap, in fine powder	66 Gm.	2 oz. av. 380 gr.
To make	100 Gm.	4 oz. av.

Mix them intimately. It is a cathartic and cholagogue, but is not extensively used to-day.

Average Dose.—Ten grains (0.65 Gm.).

PULVIS KINO ET OPII COMPOSITUS. N. F. Compound Powder of Kino and Opium

[Pulv. Kino et Opii Co.—Pulvis Kino Compositus, N.F. III]

	Metric	Old form
Kino, in fine powder	75 Gm.	3 oz. av.
Powdered Opium	5 Gm.	87½ gr.
Saigon Cinnamon, in fine powder	20 Gm.	350 gr.
To make	100 Gm.	4 oz. av.

Mix the powders intimately, pass the mixture through a moderately fine sieve, and afterwards rub it lightly in a mortar. Keep it in a stoppered bottle. It is used in diarrhœa as an astringent.

Average Dose.—Fifteen grains (1 Gm.).

PULVIS MYRICÆ COMPOSITUS. N. F. Compound Powder of Bayberry

[Pulv. Myric. Co.—Composition Powder]

	Metric	Old form
Bayberry Bark	60 Gm.	2 oz. av. 175 gr.
Jamaica Ginger	30 Gm.	1 oz. av. 87½ gr.
Capsicum	5 Gm.	87½ gr.
Clove	5 Gm.	87½ gr.
To make	100 Gm.	4 oz. av.

Reduce the substances to a moderately fine powder and mix them intimately. It is used as a carminative and stimulant, chiefly as a home remedy.

Average Dose.—Fifteen grains (1 Gm.).

PULVIS PANCREATINI COMPOSITUS. N. F. Compound Pancreatin Powder

[**Pulv. Pancreat. Co.**—Pulvis Pancreaticus Compositus, N. F. III Peptonizing Powder]

	Metric	Old form
Pancreatin	**20 Gm.**	**350 gr.**
Sodium Bicarbonate	**80 Gm.**	**3 oz. av. 87½ gr.**
To make	**100 Gm.**	**4 oz. av.**

Mix them by trituration.

Note.—One and five-tenths grammes [old form 22 grains] of this powder is sufficient to peptonize 500 mils [old form 1 pint] of fresh milk by proceeding as follows: Dissolve the compound pancreatin powder in 125 mils of tepid water, contained in a suitable flask or other vessel, and afterwards add 500 mils [old form 1 pint] of fresh milk, previously heated to 38° C. (100.4° F.). Maintain the mixture at this temperature during thirty minutes, and then transfer it to a cool place, preferably a refrigerator.

Do not use peptonized milk which has been kept longer than twenty-four hours or which has developed a bitter taste.

PULVIS RHEI ET MAGNESIÆ ANISATUS. N. F. Anisated Powder of Rhubarb and Magnesia

[**Pulv. Rhei et Magnes. Anis.**—Compound Anise Powder].

	Metric	Old form
Rhubarb, in fine powder	**35 Gm.**	**1 oz. av. 103 gr.**
Heavy Magnesium Oxide	**65 Gm.**	**2 oz. av. 128 gr.**
Anethol	**8 mils**	**130 min.**
Alcohol	**10 mils**	**162 min.**

Mix the powders, add the anethol, previously dissolved in the alcohol, and triturate until a uniform mixture results. Preserve it in well-stoppered bottles. Used as an antacid and carminative in diarrhœa.

Average Dose.—Infants, five grains (0.32 Gm.).

PULVIS TALCI COMPOSITUS. N. F. Compound Powder of Talc

[**Pulv. Talc. Co.**—Pulvis Talci Salicylicus, N. F. III Boro-Salicylated Powder of Talc]

	Metric	Old form
Salicylic Acid, in fine powder	**30 Gm.**	**420 gr**
Boric Acid, in fine powder	**100 Gm.**	**3 oz. av. 87 gr.**
Talc, in fine powder	**870 Gm.**	**27 oz. av. 367 gr.**
To make	**1000 Gm.**	**32 oz. av.**

Mix the salicylic acid and boric acid intimately and then add the talc in portions, thoroughly mixing after each addition. This is a typical formula for a medicated talc to be used as a dusting powder.

PULVERES EFFERVESCENTES. Effervescent Powders

[Granular Effervescent Salts]

This class of preparations has been described on page 264, under *Granulation,* general working formulas being included. A number of the official formulas will be found under the respective salts, and the compound mixtures are included in the following summary:

U. S. P. Granular Effervescent Salts

Title	Ingredients	Method of Preparation
Caffeina Citrata Effervescens	(See page 1373)	(See page 1373)
Potassii Citras Effervescens	(See page 725)	(See page 725)
Sodii Phosphas Effervescens	(See page 765)	(See page 765)

N. F. Granular Effervescent and Compound Salts

Sal Carolinum Factitium Artificial Carlsbad Salt	*Dry:* 2 Gm. Potassium Sulphate; 18 Gm. Sodium Chloride; 36 Gm. Sodium Bicarbonate; 100 Gm. Sodium Sulphate	Mix the Sulphates and Chloride and dry to constant weight at about 40° C. (104° F.), cool, add the Sodium Bicarbonate and mix thoroughly
	Crystalline: 2 Gm. Potassium Sulphate; 18 Gm. Sodium Chloride; 28 Gm. Monohydrated Sodium Carbonate; 100 Gm. Sodium Sulphate; 100 mils Distilled Water	Dissolve the Potassium Sulphate and Sodium Chloride in the Distilled Water, and add this solution to the other two salts, previously melted in a tared dish, at a gentle heat. Evaporate the mixture to 180 Gm., set it aside to cool, and stir it frequently, to prevent the formation of large crystals, taking care, however, that none of the salt separates in the pulverulent form. Distribute any remaining liquid uniformly over the crystals and allow to dry at air temperature. A solution of 1 Gm. of dry or 1.75 Gm. of crystalline salt in 200 mils of water is similar to an equal volume of Carlsbad (Sprudel) water in its main constituents
Carolinum Factitium Effervescens Effervescent Artificial Carlsbad Salt	266 Gm. Artificial Carlsbad Salt; 400 Gm. Sodium Bicarbonate; 157 Gm. Tartaric Acid; 250 Gm. Citric Acid	Powder the Citric Acid, mix it intimately with the other ingredients, which have been previously dried and powdered, and proceed as directed in the General Process (see page 264). A solution of 6 Gm. of the salt in 200 mils of water is similar to an equal volume of Carlsbad (Sprudel) water
Kissingense Factitium Artificial Kissingen Salt	17 Gm. Potassium Chloride; 357 Gm. Sodium Chloride; 120 Gm. Magnesium Sulphate; 107 Gm. Sodium Bicarbonate	Dry the Magnesium Sulphate to constant weight at 110° C. (230° F.); cool, add the other ingredients and mix thoroughly. A solution of 1.5 Gm. of the Salt in 200 mils of water is similar to an equal volume of Kissingen Water (Rakoczi Spring)
Kissingense Factitium Effervescens Effervescent Artificial Kissingen Salt	400 Gm. Artificial Kissingen Salt; 406 Gm. Sodium Bicarbonate; 94 Gm. Tartaric Acid; 250 Gm. Citric Acid	Powder the Citric Acid and mix intimately with the other ingredients and proceed as directed in the General Process (see page 264). A solution of 5.5 Gm. of the Salt in 200 mils of water is similar to an equal volume of Kissingen Water (Rakoczi Spring)
Lithii Citratis Effervescens	(See page 779)	(See page 779)
Potassii Bromidi Effervescens	(See page 733)	(See page 733)
Potassii Bromidi Effervescens Compositus	(See page 733)	(See page 733)
Vichyanum Factitium, Artificial Vichy Salt	846 Gm. Sodium Bicarbonate; 38.5 Gm. Potassium Carbonate; 80 Gm. Magnesium Sulphate; 77 Gm. Sodium Chloride	Dry the Magnesium Carbonate to constant weight at 110° C. (230° F.), cool, add the other ingredients, and mix thoroughly. A solution of 1 Gm. of the salt in 200 mils of water is similar to an equal volume of Vichy water (Grande Grille Spring)
Vichyanum Factitium Effervescens Effervescent Artificial Vichy Salt	250 Gm. Artificial Vichy Salt; 485.5 Gm. Sodium Bicarbonate; 164.5 Gm. Tartaric Acid; 250 Gm. Citric Acid	Prepare effervescent salt as directed under the General Process (see page 264). A solution of 3.75 Gm. of the salt in 200 mils of water is similar to an equal volume of Vichy Water (Grande Grille Spring)
Vichyanum Factitium Effervescens cum Lithio Effervescent Artificial Vichy Salt with Lithium	250 Gm. Artificial Vichy Salt; 83.3 Gm. Lithium Citrate; 441.4 Gm. Sodium Bicarbonate; 125.4 Gm. Tartaric Acid; 250 Gm. Citric Acid	Prepare an effervescent salt as directed under the General Process (see page 264)

OLEOSACCHARA. N. F. Oil-Sugars

[Elæosacchara]

	Metric	Old form
The Prescribed Volatile Oil	2 mils	32 min.
Sugar, in fine powder	100 Gm.	3 oz. av. 231 gr.

Triturate the sugar with the volatile oil until a homogeneous mixture is obtained. This is a general formula for flavored sugars which are used as a vehicle.

Triturationes. U. S. Triturations

Triturations constitute a very small class of powders recognized by the Pharmacopœia, but one trituration being official. The intention of forming them into a distinct class is to fix a definite relation between the active ingredient and the diluent. Unless otherwise directed, Triturations are to be prepared according to the following formula:

Take of	Metric	Old form
***The Substance**	10 Gm.	6 gr.
Sugar of Milk, in moderately fine powder	90 Gm.	54 gr.
To make	100 Gm.	60 gr.

Weigh the substance and the sugar of milk separately; then place the substance, previously reduced, if necessary, to a moderately fine powder, in a mortar; add about an equal measure of sugar of milk, mix well by means of a spatula, and triturate the powders thoroughly together. Then add fresh portions of the sugar of milk, from time to time, until the whole is added, and continue the trituration after each addition until the substance is intimately mixed with the sugar of milk and reduced to a fine powder.

TRITURATIO ELATERINI. U. S. Trituration of Elaterin

[Trit. Elaterin.]

	Metric	Old form
***Elaterin**	10 Gm.	6 gr.
Sugar of Milk, in moderately fine powder	90 Gm.	54 gr.
To make	100 Gm.	60 gr.

Mix them thoroughly by trituration (see *Triturationes*).

This trituration is used to replace elaterium, which is often deficient in quality. It is an efficient purgative.

Average Dose.—One-half grain (0.03 Gm.).

DISPENSING OF POWDERS AND SOLIDS

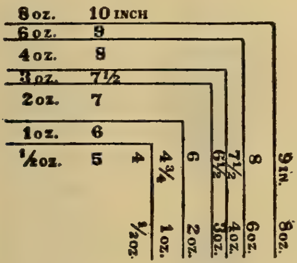
Many of the manipulations required in dispensing powders and solids, such as weighing, measuring, labeling, etc., have been described in previous chapters; therefore only those operations which are peculiar to them, or which have not been considered, will be treated in this chapter.

Folding Packages.—This is one of the first operations taught to the tyro. White paper, of good quality, should be used. It is most economical to buy the paper in quantity (several reams) and have it cut by the dealer into such sizes as the demands of the business require. Jacoby's gauge is useful in this connection; it is illustrated by Figs. 647 and 648. Fig. 647 represents the sizes of paper which are suitable for wrapping packages of the sizes indicated. In Fig.

648 the numbers indicate the method of *cutting a sheet of paper without waste.*

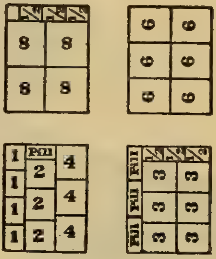
Rolls of Paper.—For general use, when packages of various and irregular sizes are to be made, wrapping paper of various qualities can now be had in cylindrical rolls. These are mounted on frames having a weighted knife, by which paper of the desired size can be easily and quickly torn off.

Fig. 647



Gauge for cutting paper

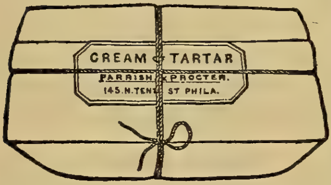
Fig. 648



Gauge for cutting paper

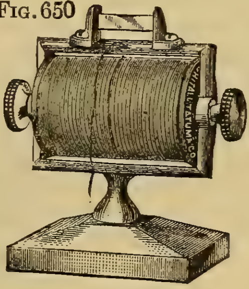
In folding a package, the proper sized paper is selected and laid upon a flat surface, the substance is deposited in the centre, and the edge nearest the operator is laid against the opposite edge, and a fold made with the thumb and forefinger. The width of the package will depend upon the width of this fold. The end of the partly formed package on the left hand is now temporarily tucked in, so that the contents shall not fall out, and the package is lifted into an upright position, with the fold toward the operator; the open upper end is then neatly creased and folded into a wedge-shaped flap. The package is now reversed, and the first partly formed tuck is loosened and folded into a flap of the same size and shape as the one just made at the other end. The edges of the package are squared and gently pinched into shape, the label is pasted on so that the edge coincides with the edge of the fold, and the package is tied, as shown in Fig. 649.

Fig. 649


CREAM OF TARTAR
PARRISH & PROCTER.
145 N. TENTH ST PHILA.

Paper package

Fig. 650



Twine reel

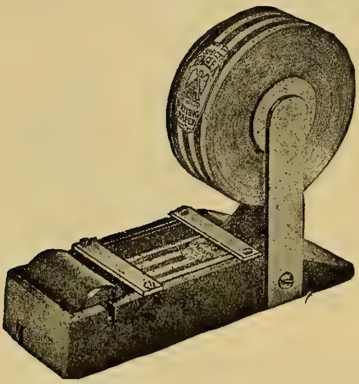
Fig. 651

Twine holder

Fig. 650 shows a very convenient twine reel. A glass twine holder, made by the Whitall Tatum Company, is shown in Fig. 651. Fig. 651a shows a roll of gummed paper, in strips, which is moistened by a wet pad as the paper is pulled off. This often replaces twine for the fastening of wrapping paper, especially for heavy packages. It is made by The Liberty Paper Company of New York.

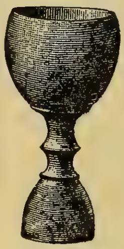
Where large quantities of powders having a uniform weight are needed, the powder measure shown in Fig. 652 may be used. This is made of hard wood, and consists of two ovoid cups of different sizes, joined like an egg cup. This measure is largely used in preparing seidlitz powders, the larger sized cup holding the requisite quantity for the alkaline mixture, the smaller cup being intended for the acid.

Fig. 651*a*



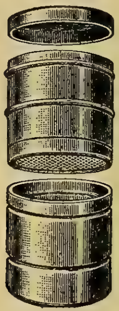
Gummed paper roll

Fig. 652



Seidlitz powder measure

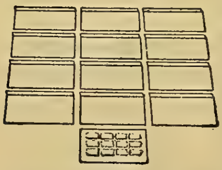
Fig. 653



Prescription sieve

The measure should never be used without carefully testing its accuracy beforehand. This is done by heaping the powder upon a piece of glazed paper and pressing the cup downward through the powder until its edge rests uniformly upon the paper. The edge of the cup is then placed upon the powder paper and slightly tapped, when the contents readily drop out. The weight should be noted, and the operation repeated several times, until the average weight is correctly determined. It will soon be possible, to regulate the pressure and height of the powder that the variation from the proper weight will practically amount to nothing. This method should not be employed where great accuracy is necessary, and the measure should be repeatedly tested. Fig. 653 shows a useful little covered sieve which may be found convenient for sifting small quantities of powders when wanted in compounding prescriptions. It is nickel plated and made in three parts.

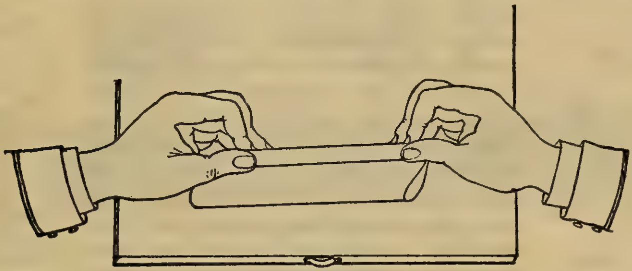
Fig. 654



Arrangement for powder papers

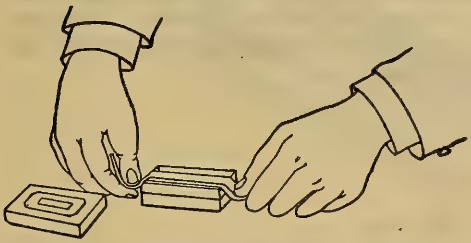
Folding Powders.—This operation is a frequent one, and the practice of accurately dividing powders is one which must be quickly acquired. The best method of attaining proficiency in this respect is to weigh out a definite quantity of a powder (120 grains), and, after dividing it into twelve equal portions, to weigh each portion separately and note the weight, so that any deviation from the proper weight (10 grains) will be discovered. Through practice it will soon be realized that very accurate division may be secured. All the powder papers should be creased at once, by folding down a margin on the side, so that they shall be uniform. They should be placed regularly and as close to one another as is convenient. In Fig. 654 the usual arrangement is shown. Where the operator has not sufficient practice to trust to his judgment of the quantity for each powder, the whole quantity may be collected upon a smooth card, flattened into a rectangular shape, and divided with a spatula into the exact number of equal portions required for the number of powder papers. Each portion may then be transferred to its appropriate paper from the card by the spatula.

Fig. 655



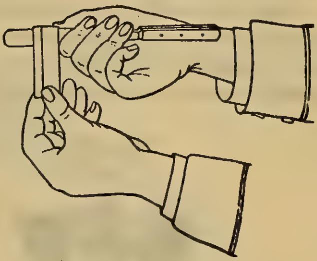
Folding the powder

Fig. 656



Making the end creases

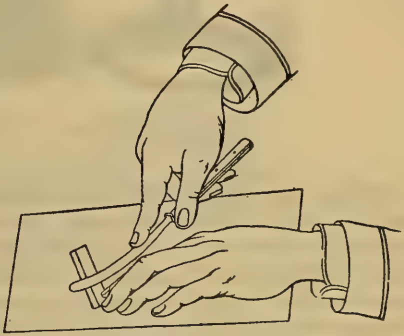
Fig. 657



Creasing with a spatula

The operation of folding the powder is illustrated in Figs. 655, 656, 657, and 658. The uncreased edge of the paper is brought over so that it lies exactly in the crease, and the fold turned down and folded over toward the operator, the depth of the fold determining the width of the powder.

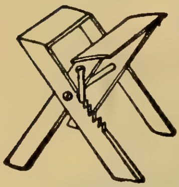
Fig. 658



Flattening the powder

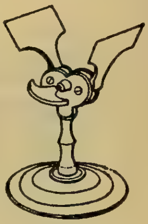
When a number of powders are called for, it is best to dispense them in a shallow powder box (see Fig. 656). It is customary to use the sides of the box as a gauge. In the hands of an experienced operator neat results are easily obtained in this way, although the use of the powder folders shown in Figs. 659 and 660 give a more uniform edge to the powders. A cheap gauge may be made by tacking a piece of tinned iron underneath a convenient shelf, so that a portion having a width slightly less than that of the powder box will project. A very true edge may be made by folding the powder over a spatula, as shown in Fig. 657, while a smooth, flat appearance is given to the powder by pressing down the folds with the blade of the spatula, as shown in Fig. 658. The paper used for folding powders should be thin, glazed cap paper, and for deliquescent substances waxed or paraffin paper should be employed. Boxes may now be secured which have hinged lids. These eliminate the danger of mixing the lids of two prescriptions and thereby changing the directions. Accidents of that kind have occurred, causing annoyance and in several cases serious consequences.

Fig. 659



Powder folder

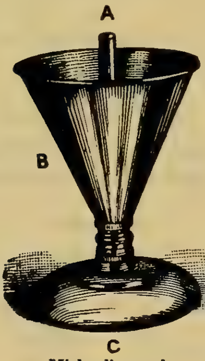
Fig. 660



Powder folder

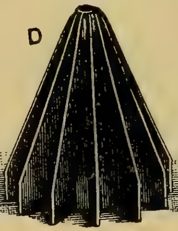
Figs. 661, 662, and 663 illustrate a very simple and ingenious apparatus for dividing powders. It was devised by Jacob C. Michael, and consists of a metallic cup, shaped like a wineglass, into which the powder that is to be divided is dropped.

Fig. 661



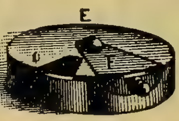
Michael's powder divider

Fig. 662



Divider

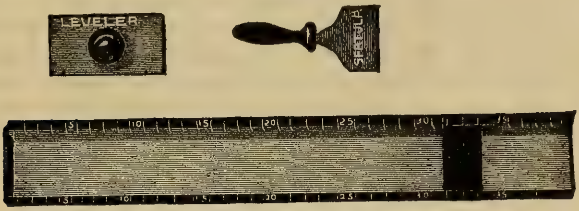
Fig. 663



Cover

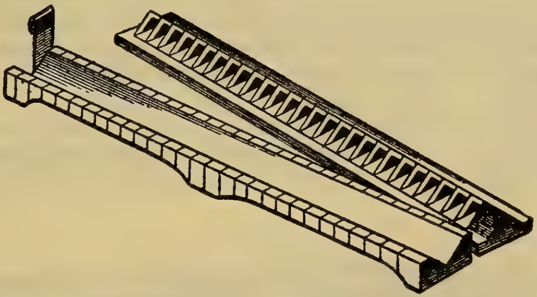
There are several dividers accompanying the apparatus; the one shown in the cut has twelve wings, making twelve partitions; the other dividers have respectively ten and eight partitions. The powder, having been thoroughly mixed, is dropped into the cup B, and the divider is placed on top by inserting the end of the stem A into the narrow end of the divider through the circular orifice which traverses the whole length and allowing it to work its way down to the bottom of the cup; this operation is promoted by slowly rotating the divider, when it will be found that the powder in the cup has been equally divided into twelve parts. The cover, E, is now placed upon the cup, care being taken to have the edge of one of the partitions of the divider correspond with the side of the door F. The whole apparatus is now turned upside down, and the stem A is removed by turning the base C and sliding it out of the orifice in the divider. The powder will be deposited upon the cover, and by holding the cover over the powder paper and opening the little door F over the center of the paper, the powder which was in one of the sections (one-twelfth of the whole) will drop out; the apparatus is then carried to the next

Fig. 664



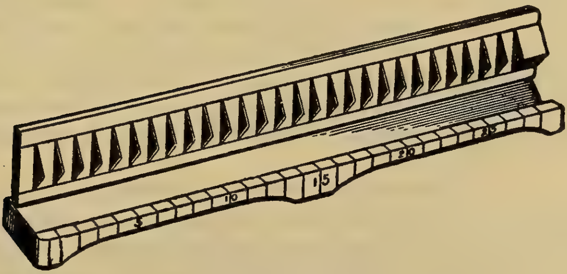
Diamond powder divider

Fig. 665



Weills's powder divider

Fig. 666

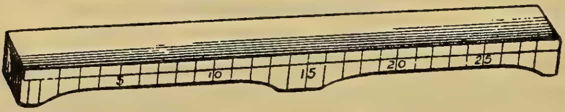


Weills's powder divider

paper, the divider rotated again until the contents of another section drop on the paper, and the process is repeated until twelve equal portions are upon as many papers. If eight or ten powders are wanted instead of twelve, the eight or ten divider is used, while if a smaller or greater number than eight, ten or twelve be required, that divider is chosen which is a multiple of the number desired.

Fig. 664 shows the nickel plated diamond powder divider made by Fox, Fultz & Co. The powder is placed in the graduated trough and the bar (shown in black in the illustration) placed opposite the graduation denoting the number of powders into which the prescription is to be divided. The powder is then placed in the trough and levelled with the aid of the "leveller," after which the bar is removed and the powder divided by inserting the short handled spatula at the graduated marks; the separated portions of powder may be then, in turn, deposited upon the powder papers arranged as shown in Fig. 654.

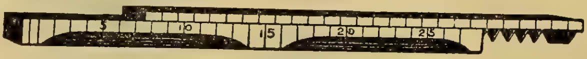
Fig. 667



Weills's powder divider

Figs. 665, 666, 667, and 668 illustrate a powder divider devised by Isaac M. Weills. Fig. 665 shows the base with its V-shaped groove, having a hinged gate at one end, which may be moved so as to open or close the end of the base; one edge of the latter is graduated as shown in the cut. In Fig. 666 the top is shown with its twenty-seven knife blades, a quarter of an inch apart. The edge of the top is graduated to correspond with the marks on the base. To use this divider, the gate is closed and the block end of the top placed at the graduated mark for the number of powders desired, and the powder placed in the groove, the top is now turned end for end and the knife blades pressed into the powder. The papers having been arranged as in Fig. 654, each paper is given its quota by gently pushing the top over the base so as to deliver the required quantity.

Fig. 668



Weills's powder divider

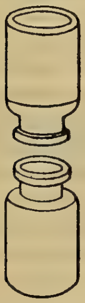
Cachets, or Wafer Capsules

The credit of bringing the *cachet*, or, as it is sometimes termed, *cachet de pain*, into use belongs to Limousin, of Paris. Wafers have been in use many years. Wafer sheet is made by pouring a mixture of flour and water upon hot greased plates, or between two hot, polished, revolving cylinders separated at a proper distance, so that the water is evaporated and a sheet of wafer produced. The properties of wafer sheet admirably fit it for administering nauseous powders. When dry, it is in non-adhesive, stiff, somewhat brittle sheets, slightly thicker than ordinary cardboard. It is tasteless, and harmless when taken into the stomach. When moistened with water, its character is entirely changed; it becomes soft, elastic, and slippery. Powders may be administered by Kollme's method, by floating a piece of wafer sheet upon water, and, when thoroughly softened, passing a tablespoon underneath and lifting it out, then depositing the powder in the centre and folding over the corners so as to thoroughly enclose it. If water is then poured into the spoon, the concealed powder may be swallowed without any disagreeable taste being perceived.

Little envelopes made of wafer sheet (Johann Schmidt's *Saccelli Amylacei*) can now be had which may be filled with bitter or nauseous powders, then sealed and moistened before swallowing; these are more convenient than the wafer sheet above described. The empty envelopes can be furnished to a patient, and he can transfer the powders from the papers which he has received from the pharmacist, and thus prepare each dose himself. The "saccelli" take up little room, and if the patient is travelling, they serve a useful purpose.

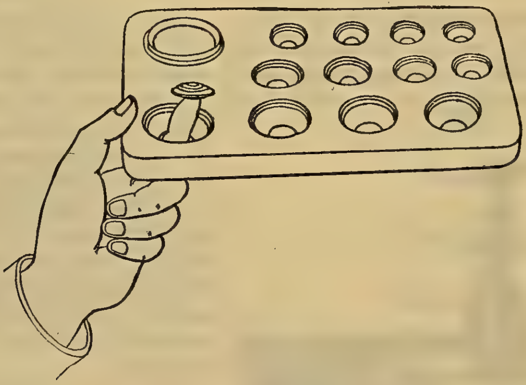
The cachet is an improvement on the above, because no more wafer sheet is used than is absolutely necessary to enclose the powder, and thus the bulk is diminished. Cachets are lenticular or spoon shaped disks of wafer sheet, of various sizes. The powder is deposited in the dry cachet, and the margin is moistened with water. An empty cachet of exactly the same size is placed on top, with the convexity upward, and pressure is made upon the margin, with the effect of tightly sealing the cachet and enveloping the powder. Elaborate apparatus—the necessity for which, however, is not apparent—has been devised to effect the sealing of the cachets. The simplest method upon the small scale is as follows: Two bottles are provided (a morphine bottle for the middle sized cachet answers very well), and, one of the cachets being placed upon the lip of one bottle, the

Fig. 669



Bottle for sealing cachets

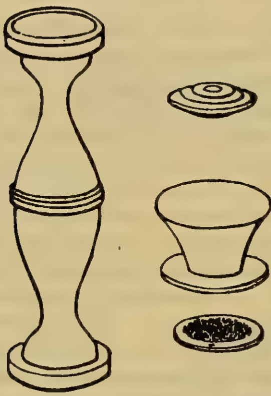
Fig. 670



Limousin's cachet board

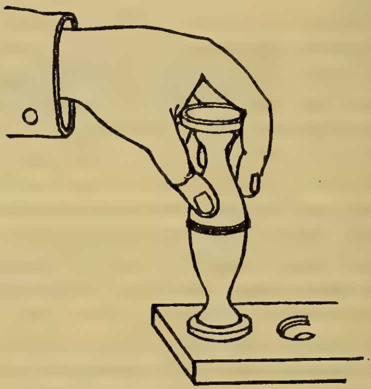
powder is carefully deposited in the centre without soiling the outside edge; the margin of an empty cachet of the same size is then moistened by quickly passing it over a piece of wet felt, and is laid upon the cachet containing the powder; the lip of the other bottle is now applied to the cachet with sufficient pressure to seal it effectually. The position of the bottles is shown in Fig. 669. Limousin's improved method is similar in principle, although, of course, more finished. A board, with depressed perforations for three sizes is shown in Fig. 670. Empty cachets are placed upon the depressions, and the powder is deposited in the centre with the aid of the small powder funnel (see Fig. 671). The "wetter and presser" is shown to the left of the funnel; this is of two kinds of wood, joined in the middle,—one end being hard, light colored, and highly polished, the other being dark colored and somewhat absorbent. The end of the latter is used to moisten the margin of the cachet by first placing it upon a piece of moist felt and then applying it to the cachet; an empty cachet is now laid upon the one containing the powder, and the "presser" end is applied with some force so as to seal the cachet (see Fig. 672); the sealed cachet is pushed up from below, as shown in Fig. 670.

FIG. 671



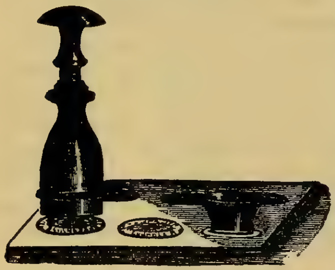
Cachet wetter, finished cachet, cachet funnel, and cachet containing powder

FIG. 672



Sealing the cachet

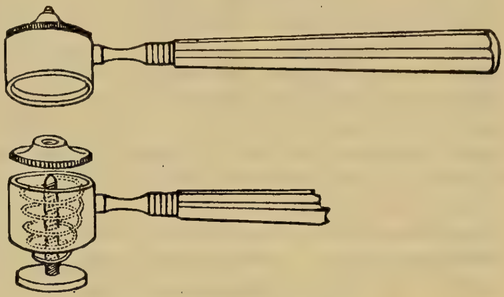
FIG. 673



German cachet apparatus

A less expensive apparatus for filling and sealing cachets than that made by Limousin may be obtained from the German importing houses (see Fig. 673). A rectangular sheet of thick rubber cloth is perforated with twelve circular holes, each large enough to hold an empty cachet; the powder is deposited in the centre of the cachet through a small funnel; the inner edge of an empty cachet is dampened by rubbing it for a moment upon a piece of cotton flannel moistened with water, the moistened cachet is laid upon the one containing the powder so as to enclose it, and the presser, which is armed at its base with three needles and has a spring in the handle, is applied so that the cachet is sealed, and when the spring is released the needles penetrate the edge of the finished cachet sufficiently so that it can be lifted and dropped into the box without touching it with the hands.

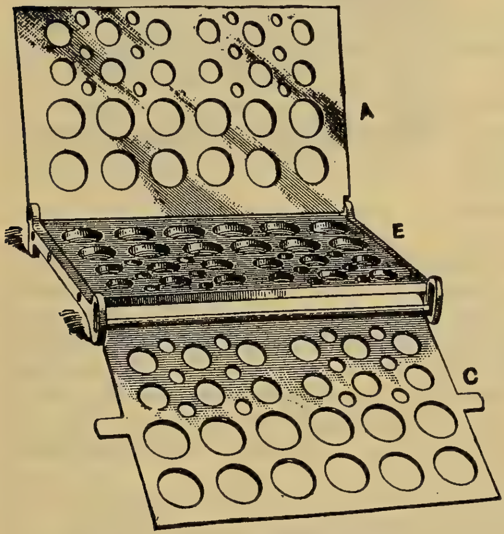
Fig. 674



Powder measurer for cachets

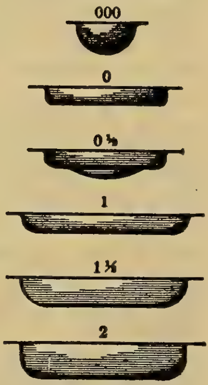
Limousin devised a powder measurer, the construction of which is shown in Fig. 674. The upper view shows the measurer closed, ready for use; the lower view shows how its capacity may be varied to suit the weight of the powder desired. This is done by turning the milled head, which revolves upon the screw which is attached to the disk forming the movable bottom of the cup. A coiled spring aids in pushing the disk outward when it is necessary to lessen the capacity, so that this can be regulated with great exactness. The value of this measurer lies in the fact that it can be used for delivering a more or less compact disk of powder in a cachet without soiling the edges of the latter, and when a large number of cachets of a definite weight are needed,—*i.e.*, one gramme guarana powders,—it can be used as is the seidlitz powder measure (see Fig. 652).

Fig. 675



Konseal apparatus

Fig. 676



Konseals (exact size)

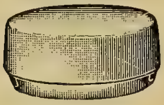
J. M. Grosvenor & Co., of Boston, have introduced an excellent apparatus for dispensing cachets. It is made in a very substantial manner, and consists of three nickelled metal plates hinged together as shown in Fig. 675. The cachets, which are termed "konseals," are made of thinner material than ordinary cachets, and the finished cachet is less bulky and neater in appearance.

The saucer shaped cachets are pressed with the fingers into the inner circles of plate E, and also into those on plate A; plate C is then laid upon plate E, and the medicated powder dropped through the funnel into the cachet. Large doses may be pressed with a thimble furnished for the purpose, and thus smaller cachets may be used than are possible in ordinary apparatus.

When the cachets are filled, the filling plate is lifted and a dampening roller passed over the edges of the empty capsules in plate A. The latter is then closed over the bottom plate, and a slight pressure seals the cachet. On opening the apparatus the filled cachets may be easily removed by pushing each one gently out with the finger.

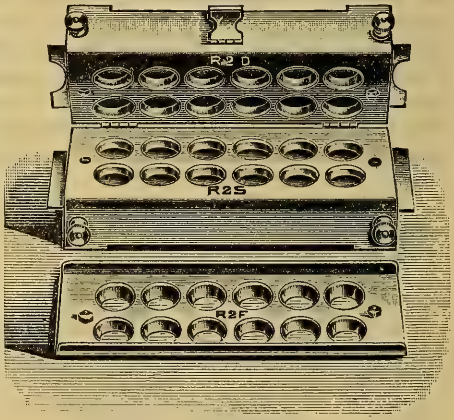
Fig. 676 shows the exact sizes of the wafer konseals. No. 000 permits the administration of a cachet not larger than a large sized pill.

FIG. 677



Dry seal cachet

FIG. 678



Dry seal cachet apparatus

The name "konseals" was adopted by J. M. Grosvenor & Co. as shorter and better adapted for prescription use than "Morstadt's cachets," which was their original name. They were contrived by Karl Morstadt, of Prague, Austria.

Fig. 677 shows Johann Schmidt's dry seal cachet. The advantage of this form is that there are no "flanges," as in the ordinary cachet. They are made of very thin, elastic wafer sheet; the manner of closing the dry seal cachet resembles that used for "empty" gelatin capsules. The "cap" fits over the body, and no moistening is required, as the pressure forces the cap tightly over the edge of the body containing the powder. The apparatus shown in Fig. 678 is similar in construction to the "konseal" apparatus above described.

It is greatly to be regretted that wafer capsules are not more frequently prescribed. They have many substantial advantages. The substance is rendered tasteless by their use, and yet is easily liberated in the stomach in a pulverulent condition, and this is well known to be the most favorable solid form for solution in the gastric fluids; the knack of swallowing them is easily acquired; the pharmacist has the great advantage of furnishing preparations which are not ready made, and the purity of the ingredients can be personally vouched for.

Tabellae *Tablets, Tablet Triturates*

Tablets, or tablet triturates, may be defined as minute disk-like masses of medicinal powders, the basis usually consisting of powdered sugar of milk, or a mixture of sugar of milk and cane sugar. A tablet made from sugar of milk alone is too easily crushed so that usually a mixture consisting of sugar of milk, 5 parts, cane sugar, 1 part, is used. The powder is held together and the tablet retains its shape through the adhesion of the particles which is developed by the use of a volatile liquid like alcohol.

Tablet triturates originated with Dr. Robert M. Fuller, and neither process nor apparatus is patented. Since his first communication on the subject, in 1878, they have been largely manufactured, and pharmacists owe a debt to Dr. Fuller for voluntarily giving them a very neat and ingenious process whereby many medicines can be satisfactorily administered.

Fig. 679

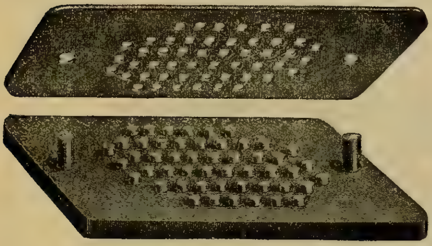
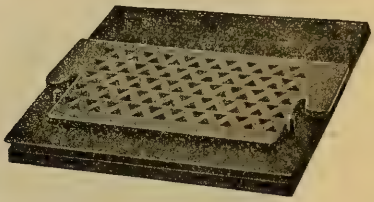


Fig. 680



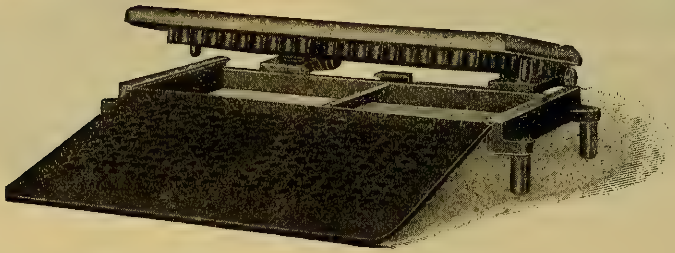
Tablet triturate machines

The tablet is made by pressing a paste into perforations made in a plate of hard rubber, metal, glass, or other suitable material. These holes are of uniform diameter, and the plate must have a uniform thickness throughout. The number of holes in the plate is determined by their relative size, plates having been made with as many as three hundred perforations. Using various plates the tablets weigh from half a grain to four grains.

In using the apparatus, the upper plate is placed upon a pill tile or plate of glass, and the paste is spread upon the upper surface and rubbed into the small holes with a spatula. When all of the holes are filled, the excess of paste is brushed from the surface, some of the dry triturate is dusted over both sides of the plate, and the latter set aside for a few minutes. The upper plate is then lifted over the lower plate and laid upon it so that the two long pegs enter the corresponding holes (see Fig. 679). Now, by pressing firmly but gently upon the upper plate the pegs are forced upward slowly until the plates come together and a tablet rests upon the top of each peg; the apparatus is then set aside to permit the tablets to dry, when they are taken off, and the plates, after brushing, are ready for another operation. Fig. 680 shows another style of mould.

It will usually be found desirable to have several sets of plates, so that they may be worked continuously, the tablets drying upon one while another is being used for forming the tablets. The paste may be made by adding the medicating ingredient in fine powder to finely powdered sugar or sugar of milk and moistening it with alcohol. Sugar of milk alone makes a tablet which is soft and easily crushed, so that the usual mixture consists of sugar of milk, 5 parts, cane sugar, 1 part. For oxidizable substances, kaolin or precipitated chalk have been used as diluents. In some rare cases a little powdered acacia may be needed, but care must be observed not to get the paste too tenacious nor too soft, as there may be difficulty in forcing the tablets out of the perforations, or they may take a long time to dry.

Fig. 681



Colton's No. 1 triturate machine

Tablets used for hypodermic medication may be advantageously made by this process. Accurate adjustment of the ingredients and prolonged trituration, so that each tablet shall contain its due proportion of activity and thorough desiccation, are the important details in the manufacture of tablet triturates.

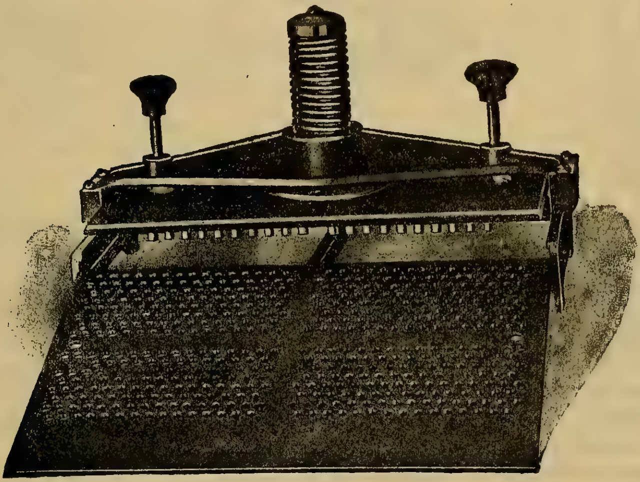
To avoid the development of moulds on the tablets they must be thoroughly dried before bottling, by spreading them upon a frame covered with muslin, and exposing them to currents of warm air.

In developing a formula or deciding upon the amount of material required for a given number of tablets, the weight of the diluent which exactly fills all of the openings in the mould is determined by an experiment. This amount of diluent is then weighed and placed in a pile on the work counter, and by its side is placed the total amount of medication for the number of tablets made by the mould. A bulk of the diluent equal to the bulk of the medication is now withdrawn, the medication and remaining diluent mixed by trituration and the resulting triturate moistened and forced into the openings in the moulds. If they are not completely filled more diluent is added, its weight noted, and the formula then made up from the results of the experiment.

Figs. 681 and 682 show Colton's No. 1 and No. 2 triturate machines.

Many of the tablets sold to-day as tablet triturates are compressed on a regular tablet machine (see page 1767), being made in all respects like compressed tablets. They, of course, represent the principles of a triturate, *i.e.*, a small amount of medication and a diluent, uniformly mixed by trituration. It is less costly to make them on a compressing machine if the apparatus is at hand than by the moulding process.

Fig. 682



Colton's No. 2 triturate machine

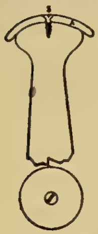
Tablet triturates have been made "in blank"—that is, without medication. When medicating liquids have been added to them they are termed *tablet saturates*.

Trochisci *Troches*

Troches, or lozenges, are solid, discoid or cylindrical masses, consisting chiefly of medicinal powders, sugar, and mucilage. They are intended to be used by placing them in the mouth and permitting them to remain until, through slow solution or disintegration, their purpose of mild medication is effected. It is obvious that very powerful or disagreeable remedies cannot be administered in this way. The formation of the "lozenge mass" is the most important part of the operation. The dry powders must be made into a tenacious mass which shall possess sufficient plasticity to enable it to be rolled into a flat cake without crumbling. It must not retain moisture so long as to occasion too much delay in drying the troches, and the troches must not be brittle through want of sufficient adhesiveness. Mucilage of tragacanth has been found best to serve the purpose of causing the adhesion of the powders.

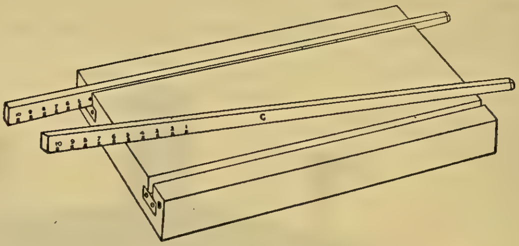
Making the Mass.—The best method of making the mass is first to prepare the mucilage according to the formula, and, having mixed and sifted the powders, add sufficient mucilage to make a mass of the proper consistence. The quantity always depends upon the character of the powder. If the latter is absorbent, more mucilage is required than if the powder is made up largely of extracts. The usual method of mixing powdered tragacanth or acacia with the dry powders, and then trusting to the addition of the right proportion of water, is generally disappointing in the hands of the inexperienced, almost invariably producing too moist a mass. Upon the large scale the manufacturer employs a mixing machine to form the mass; upon the small scale the pharmacist uses the mortar and pestle. The mortar clamp, shown in Fig. 484, is very useful in this connection and in working tough masses. Hahn's pestle cap will save blistering the hands of the inexperienced. This device, shown in Fig. 683, consists of a brass cup shaped cap, A, perforated in the centre, and screwed to the top of the pestle at S, so as to permit of the slow revolution of the cap when the pestle is tightly grasped in the hand; the lower cut shows another view of the cap.

Fig. 683



Hahn's pestle cap

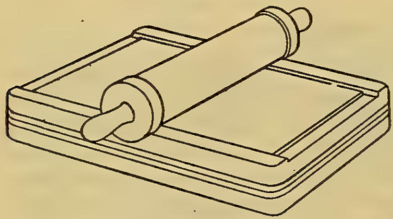
Fig. 684



Slocum's lozenge board

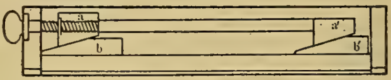
Rolling the Mass.—When the mass is made, it must be formed into a flat cake by placing it upon a hard, level, dusted surface and rolling it with a cylindrical roller. The thickness of the cake determines the weight of the lozenge, and hence it is more exact to have some means of adjusting the thickness. In Slocum's lozenge board (see Fig. 684) this is ingeniously effected by the use of tapering oak strips, C, which slide in inclined furrows; the handles of the strips are graduated, having saw kerfs at regular intervals; the brass plate, B, permits these to be accurately adjusted and held, so that both strips project uniformly above the board. By pushing both strips forward, greater thickness of the lozenge cake is secured.

Fig. 685



Harrison's lozenge board

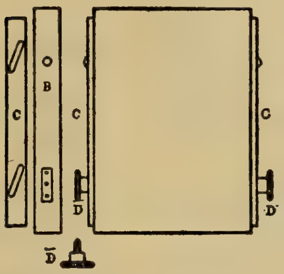
Fig. 686



Harrison's lozenge board (sectional view)

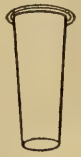
Harrison's lozenge board is shown in Figs. 685 and 686. The board is surrounded by a frame, and the former can be elevated or depressed uniformly by turning the screw shown in the sectional view in Fig. 686. The handles of the roller form one continuous piece, running through a longitudinal hole through its centre. This permits the handles to be grasped tightly while the roller revolves. Lozenge rollers should be true cylinders, and are generally made of hard wood. Steel rollers and glass rollers have been used, however. These are both made hollow, so that hot water can be introduced through the holes made where the handles are screwed in. Hollow lozenge rollers of this kind are used when heated for rolling stiff extractive masses.

Fig. 687



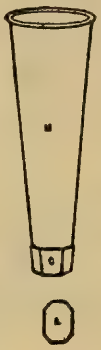
Procter's lozenge board

Fig. 688



Lozenge punch

Fig. 689

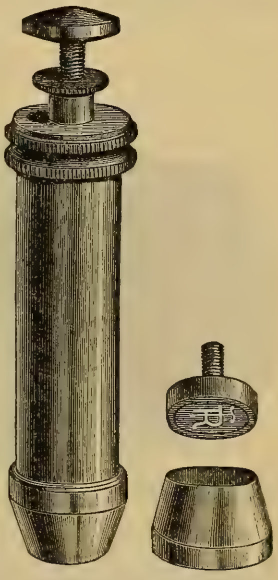


Lozenge punch (steel cutter)

A convenient lozenge board was devised by Wallace Procter (see Fig. 687). The board, made of well seasoned wood, is 14 inches long, 10 inches wide, and 1½ inches thick. At each side, about 3 inches from each end, a plate, B, is let in and securely fastened; the brass plates, C, are movable, and are held in place by pins at one end and square shouldered screws, D, at the other end; the side plates, C, are raised or lowered and fixed at any height desired by the set screw, D.

Cutting the Troches.—Troches are cut by cylindrical or conical punches, often made of tinned iron, as shown in Fig. 688, but preferably of steel. Fig. 689 shows a very good punch, having a hardened steel octagonal cutter, C, soldered to a hollow conical handle, M. Fig. 690 represents a very complete lozenge cutter with a circular die, which stamps a letter upon a lozenge in addition to cutting it. It was obtained by the author from Chicago. It is made very substantially, and is accompanied by a cutter and a die for oval lozenges. Fig. 692 shows the Franciscus lozenge punch. The cutter is

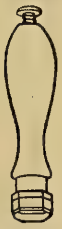
Fig. 690



Lozenge cutter, with die

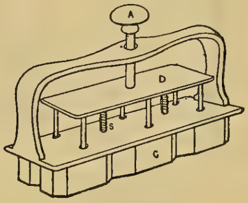
of steel and a coiled spring at the top of the handle pushes the lozenge out after it is cut. Fig. 693 shows an excellent cutter which accurately cuts six lozenges at once. It was devised by a Western pharmacist. Fig. 694 gives the end view. The cutter is placed upon the soft mass and pressed down until the edges touch the board. By pressing upon the handle, A, the lozenges are forced out of the cutters, the springs, S, causing the pushers to resume their original position.

Fig. 692



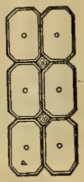
The Franciscus lozenge punch

Fig. 693



Lozenge cutter

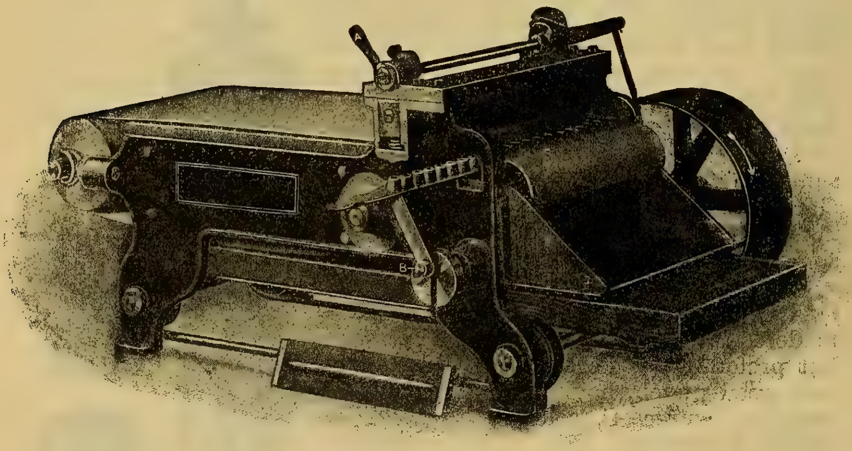
Fig. 694



Lozenge cutter (end view)

Fig. 695 shows Colton's lozenge cutting machine. The mass, having been previously rolled into a flat cake of the desired thickness, is placed upon the moving rubber belt, which carries it forward to a finishing roller which gives it the necessary evenness of surface; it then passes under the tapering cutters, and the lozenges drop downward to a tray or receiver.

Fig. 695



Colton's lozenge cutting machine

U. S. P. Troches

Trochisci Acidi Tannici	Made by forming a mass, with the aid of Stronger Orange Flower Water, from 6 Gm. of Tannic Acid, 65 Gm. of Sugar, and 2 Gm. of Tragacanth, and dividing it into 100 troches
Ammonii Chloridi	Made by forming a mass, with the aid of Syrup of Tolu, from 10 Gm. of Ammonium Chloride, 20 Gm. of Extract of Glycyrrhiza, 2 Gm. of Tragacanth, and 40 Gm. of Sugar, and dividing it into 100 troches
Cubebæ	Made by forming a mass, with the aid of Syrup of Tolu, from 25 Gm. of Extract of Glycyrrhiza and 12 Gm. of Acacia, with which 2 Gm. of Oleoresin of Cubeb and 1 mil of Oil of Sassafras have been thoroughly incorporated, and dividing it into 100 troches
Potassii Chloratis	Made by forming a mass, with the aid of Water, from 15 Gm. of Potassium Chlorate, 60 Gm. of Sugar, and 3 Gm. of Tragacanth, and dividing it into 100 troches
Sodii Bicarbonatis	Made by forming a mass, with the aid of Mucilage of Tragacanth, from 18 Gm. of Sodium Bicarbonate, 54 Gm. of Sugar, and 1 Gm. of Myristica and dividing it into 100 troches

N. F. Troches

Trochisci Carbonis Ligni	Made by forming a mass by the aid of water from 30 Gm. of Wood Charcoal, 4 Gm. of Tragacanth, 66 Gm. of powdered sugar and 0.3 Gm. of Vanillin, and dividing into 100 troches
Gambir	Made by forming a mass, with the aid of Water, from 6 Gm. of Gambir, 91 Gm. of Sugar, 3 Gm. of Tragacanth, and 0.2 mil of Oil of Cinnamon and dividing it into 100 troches
Menthæ Piperitæ	Made by forming a mass by the aid of Mucilage of Tragacanth from 1 mil of Oil of Peppermint, and 100 Gm. of Sugar and dividing into 100 troches
Phenolphthaleini	Made by forming a mass by the aid of water from 6 Gm. of Phenolphthalein, 10 Gm. of Acacia, 84 Gm. of Sugar, 0.3 Gm. of Vanillin and 0.1 Gm. of Carmine, and dividing into 100 troches
Quininæ Tannatis	Made by forming a mass by the aid of Water and Chloroform from 6 Gm. of Quinine Tannate, 3 Gm. of Tragacanth, 5 Gm. of Oil of Theobroma, 25 Gm. of Cocoa, 60 Gm. of Sugar, 0.3 Gm. Vanillin and 0.2 Gm. of Sodium Benzosulphinide and dividing into 100 troches
Santonini	Made by forming a mass, with the aid of Water, from 3 Gm. of Santonin, 54 Gm. of Sugar, 40 Gm. of Cocoa, 0.1 Gm. of Vanillin and 3 Gm. of Tragacanth, and dividing it into 100 troches
Santonini Compositi	Made by forming a mass by the aid of Water from 3 Gm. of Santonin, 3 Gm. of Mild Mercurous Chloride, 3 Gm. of Tragacanth, 51 Gm. of Sugar and 40 Gm. of Cocoa and 0.1 Gm. of Vanillin and dividing into 100 troches
Sulphuris et Potassii Bitartratis	Made by forming a mass by the aid of Water from 30 Gm. of Washed Sulphur, 6 Gm. of Potassium Bitartrate, 4 Gm. of Tragacanth, 60 Gm. of Sugar and 0.5 mil of Oil of Orange and dividing into 100 troches
Ulmi	Made by forming a mass by the aid of Water from 20 Gm. of Elm, 1 Gm. of Tragacanth, 79 Gm. of Sugar, and 0.2 mil of Methyl Salicylate and dividing into 100 troches

Unofficial Troches or Lozenges

Name	Ingredients	Preparation
Trochiscus Acidi Benzoici. Br.	0.03 Gm. Benzoic Acid	Mix with Fruit Basis[4] to form a lozenge
Acidi Carbolici. Br.	15 Gm. Phenol; 500 Gm. Refined Sugar; 45 Gm. Gum Acacia; 15 Gm. Tragacanth; 45 mils Lemon Juice	Mix and make into 500 lozenges; dry
Trochisci Antiacidi B.P.C.	22.68 Gm. Precipitated Calcium Carbonate; 16.20 Gm. Magnesium Carbonate; 6.48 Gm. Sodium Chloride, Simple Basis a sufficient quantity	Mix, form a mass and divide into 100 troches
Trochiscus Bismuthi Compositus. Br.	0.15 Gm. each of Bismuth Oxycarbonate and Heavy Magnesium Carbonate; 0.30 Gm. Precipitated Calcium Carbonate	Mix with Rose Basis[3] to form a lozenge
Catechu Br.	0.06 Gm. Catechu	Mix with Fruit Basis[4] to form a lozenge
Trochisci Cretæ. U. S. P. 1890	25 Gm. Prepared Chalk; 7 Gm. Acacia; 3 mils Spirit of Nutmeg, 40 Gm. Sugar; Water, sufficient to make 100 troches	Rub the powders with the Spirit of Nutmeg until thoroughly mixed, form a mass with Water, and divide into 100 troches
Trochisci Ferri. U. S. P. 1890	30 Gm. Ferric Hydrate; 1 Gm. Vanilla, cut; 100 Gm. Sugar; Mucilage of Tragacanth, sufficient to make 100 troches	Rub the Vanilla with a portion of the Sugar to a fine powder, add the Ferric Hydrate and remainder of the Sugar, form a mass with Mucilage, and divide into 100 troches
Trochiscus Ferri Redacti. Br.	0.06 Gm. Reduced Iron	Mix with the Simple Basis[1] to form a lozenge

Unofficial Troches or Lozenges—*Continued*

Name	Ingredients	Preparation
Trochiscus Guaiaci Resinæ Br.	0.2 Gm. Guaiacum Resin	Mix with the Fruit Basis[4] to form a lozenge
Trochisci Ipecacuanhæ. U. S. P. 1890	2 Gm. Ipecac; 2 Gm. Tragacanth; 65 Gm. Sugar; Syrup of Orange to make 100 troches	Mix the powders intimately, form a mass with the aid of Syrup of Orange, and divide into 100 troches
Trochiscus Kino Eucalypti. Br.	0.06 Gm. Eucalyptus Kino	Mix with Fruit Basis[4] to form a lozenge
Trochiscus Krameriæ. Br.	0.06 Gm. Extract of Krameria	Mix with Fruit Basis[4] to form a lozenge
Trochiscus Krameriæ et Cocainæ. Br.	0.06 Gm. Extract of Krameria; 0.003 Gm. Cocaine Hydrochloride	Mix with the Fruit Basis[4] to form a lozenge
Trochisci Mentholis Compositi B. P. C.	4.86 Gm. Potassium Chlorate; 1.62 Gm. Menthol; 0.16 Gm. Betacaine Hydrochloride	Mix, form a mass by the aid of Fruit Basis[4] and divide into 100 troches
Trochiscus Morphinæ. Br.	0.002 Gm. Morphine Hydrochloride	Mix with the Tolu Basis[2] to form a lozenge
Trochiscus Morphinæ et Ipecacuanhæ Br.	0.002 Gm. Morphine Hydrochloride; 0.006 Gm. Ipecac	Mix with the Tolu Basis[2] to form a lozenge
Trochiscus Sulphuris. Br.	150 Gm. Precipitated Sulphur; 30 Gm. Acid Potassium Tartrate; 275 Gm. Sugar; 30 Gm. Gum Acacia; 30 mils Tincture of Orange; 30 mils Mucilage of Gum Acacia	Thoroughly incorporate the Tincture of Orange with the mixed powders, form a mass with the aid of the Mucilage, and divide it into 500 lozenges
Trochisci Zingiberis. U. S. P. 1890	20 mils Tincture of Ginger; 4 Gm. Tragacanth; 130 Gm. Sugar; Syrup of Ginger to make 100 troches	Thoroughly incorporate the Tincture of Ginger with the Sugar, dry it in the air, add the Tragacanth, form a mass with the aid of the Syrup, and divide into 100 troches

1. **Preparation of Lozenges with Simple Basis.** Br.—Mix 500 times the quantity of drug ordered for one lozenge with 496 Gm. of powdered sugar and 19.5 Gm. of powdered gum acacia, form a mass with the aid of 35 mils of mucilage of gum acacia and sufficient distilled water, and divide it into 500 lozenges. Dry them.

2. **Preparation of Lozenges with Tolu Basis.** Br.—Take 500 times the quantity of drug ordered for one lozenge, dissolve alkaloids, if present, in 10 mils of water, mixing the solution thoroughly with 482 Gm. of powdered sugar and 19.5 Gm. of powdered gum acacia, then incorporate any other ingredients ordered and 10 mils of tincture of balsam of tolu, form into a mass with 35.5 mils of mucilage of gum acacia and sufficient distilled water, and divide it into 500 lozenges. Dry them.

3. **Preparation of Lozenges with Rose Basis.** Br.—Mix 500 times the quantity of drug ordered for one lozenge with 496 Gm. of powdered sugar and 19.5 Gm. of powdered gum acacia, form into a mass with the aid of 35 mils of mucilage of gum acacia and 0.025 mils of oil of rose, and divide into 500 lozenges. Dry them.

4. **Preparation of Lozenges with Fruit Basis.** Br.—Mix 500 times the quantity of drug ordered for one lozenge with 26 Gm. of powdered sugar and 6.5 Gm. of tragacanth, form into a mass with the aid of sufficient black-current paste of commerce, to make 650 Gm., and divide into 500 lozenges. Dry them.

TROCHISCI ACIDI TANNICI. U. S. Troches of Tannic Acid

[Troch. Acid. Tann.]

	Metric	Old form
***Tannic Acid**................................	**6 Gm.**	**93 gr.**
Sugar, in fine powder...........................	**65 Gm.**	**2 oz. av. 128 gr.**
Tragacanth, in fine powder.....................	**2 Gm.**	**31 gr.**
Stronger Orange Flower Water, a sufficient quantity,		
To make one hundred troches	**100**	100

Rub the powders together until they are thoroughly mixed; then form a mass with stronger orange flower water and divide it into 100 troches.

TROCHISCI AMMONII CHLORIDI. U. S. Troches of Ammonium Chloride

[Troch. Ammon. Chlor.]

	Metric	Old form
***Ammonium Chloride,** in fine powder	10 Gm.	154 gr.
Extract of Glycyrrhiza, in fine powder	20 Gm.	309 gr.
Tragacanth, in fine powder	2 Gm.	31 gr.
Sugar, in fine powder	40 Gm.	1 oz. av. 180 gr.
Syrup of Tolu,		
To make one hundred troches	100	100

Rub the powders together until they are thoroughly mixed; then form a mass with syrup of tolu and divide it into 100 troches.

TROCHISCI CUBEBÆ. U. S. Troches of Cubeb

[Troch. Cubeb.]

	Metric	Old form
***Oleoresin of Cubeb**	2 Gm.	31 gr.
Oil of Sassafras	1 mil	16 min.
Extract of Glycyrrhiza, in fine powder	25 Gm.	386 gr.
Acacia, in fine powder	12 Gm.	185 gr.
Syrup of Tolu, a sufficient quantity,		
To make one hundred troches	100	100

Rub the powders together until they are thoroughly mixed; then add the oleoresin and the oil, and incorporate them with the mixture. Lastly form a mass with syrup of tolu and divide it into 100 troches.

TROCHISCI POTASSII CHLORATIS. U. S. Troches of Potassium Chlorate

[Troch. Pot. Chlorat.]

	Metric	Old form
***Potassium Chlorate,** in fine powder	15 Gm.	231 gr.
Sugar, in fine powder	60 Gm.	2 oz. av. 51 gr.
Tragacanth, in fine powder	3 Gm.	46 gr.
Water, a sufficient quantity,		
To make one hundred troches	100	100

Mix the sugar with the tragacanth by trituration in a mortar; then transfer the mixture to a sheet of paper, and by means of a bone or wooden spatula mix it with the potassium chlorate, being careful to avoid unnecessary trituration or pressure, which might cause the mixture to ignite or explode. Lastly form a mass with water and divide into 100 troches.

TROCHISCI SODII BICARBONATIS. U. S. Troches of Sodium Bicarbonate

[Troch. Sod. Bicarb.]

	Metric	Old form
***Sodium Bicarbonate**	18 Gm.	278 gr.
Sugar, in fine powder	54 Gm.	1 oz. av. 396 gr.
Myristica, freshly grated	1 Gm.	15 gr.
Mucilage of Tragacanth, a sufficient quantity,		
To make one hundred troches	100	100

Triturate the myristica with the sugar, gradually added, until they are reduced to a fine powder, and mix this intimately with the sodium bicarbonate; then form a mass with the mucilage of tragacanth and divide it into 100 troches.

TROCHISCI CARBONIS LIGNI. N. F. Troches of Charcoal

[Troch. Carb. Lig.]

	Metric	Old form
Wood Charcoal, in No. 100 powder	30.0 Gm.	1 oz. av. 25 gr.
Tragacanth, in fine powder	4.0 Gm.	62 gr.
Sugar, in fine powder	66.0 Gm.	2 oz. av. 144 gr.
Vanillin	0.3 Gm.	5 gr.
Water, a sufficient quantity,		
To make one hundred troches	100	100

Triturate the vanillin with 20 Gm. [old form 309 grains] of sugar until reduced to a fine powder, add the remainder of the sugar and the other ingredients, mix thoroughly, and form a mass with water. Divide this into 100 troches and dry them in a current of warm air.

Average Dose.—One troche.

TROCHISCI GAMBIR. N. F. Troches of Gambir

(U. S. P. VIII)

[Troch. Gambir]

	Metric	Old form
Gambir, in fine powder	6.0 Gm.	93 gr.
Tragacanth in fine powder	3.0 Gm.	46 gr.
Sugar, in fine powder	91.0 Gm.	3 oz. av. 92 gr.
Oil of Cinnamon	0.2 mil	3 min.
Water, a sufficient quantity,		
To make one hundred troches	100	100

Rub the powders together until well mixed; then incorporate the oil, and form a mass with water. Divide this into 100 troches and dry them in a current of warm air.

Average Dose.—One troche.

TROCHISCI MENTHÆ PIPERITÆ. N. F. Troches of Peppermint

[Troch. Menth. Pip.]

	Metric	Old form
Oil of Peppermint	1 mil	16 min.
Sugar, in fine powder	100 Gm.	3 oz. av. 231 gr.
Mucilage of Tragacanth, a sufficient quantity,		
To make one hundred troches	100	100

Triturate the oil of peppermint and the sugar together until they are thoroughly mixed; then form a mass with mucilage of tragacanth, and divide it into 100 troches. Dry them in a current of warm air.

Average Dose.—One troche.

TROCHISCI PHENOLPHTHALEINI. N. F. Troches of Phenolphthalein

[Troch. Phenolphthal.]

	Metric	Old form
Phenolphthalein, in fine powder	6.0 Gm.	93 gr.
Acacia, in fine powder	10.0 Gm.	154 gr.
Sugar, in fine powder	84.0 Gm.	2 oz. av. 421 gr.
Vanillin	0.3 Gm.	5 gr.
Carmine	0.1 Gm.	1½ gr.
Water, a sufficient quantity,		
To make one hundred troches	100	100

Triturate the carmine and vanillin with 20 Gm. [old form 309 grains] of sugar until uniformly mixed, then add the remainder of the sugar and the other ingredients, mix thoroughly and form a mass with water. Divide this into 100 troches, and dry them in a current of warm air.

Average Dose.—One troche.

TROCHISCI QUININÆ TANNATIS. N. F. Troches of Quinine Tannate

[Troch. Quin. Tan.]

	Metric	Old form
Quinine Tannate	6.0 Gm.	93 gr.
Tragacanth, in fine powder	3.0 Gm.	46 gr.
Oil of Theobroma	5.0 Gm.	77 gr.
Cocoa, in fine powder	25.0 Gm.	386 gr.
Sugar, in fine powder	60.0 Gm.	2 oz. av. 51 gr.
Vanillin	0.3 Gm.	5 gr.
Sodium Benzosulphinide	0.2 Gm.	3 gr.
Chloroform,		
Water, each, a sufficient quantity,		
To make one hundred troches	100	100

Triturate the sodium benzosulphinide and the vanillin with 20 Gm. [old form 309 grains] of sugar until uniformly mixed, add the remainder of the sugar, the tragacanth, and cocoa and mix thoroughly. Triturate the quinine tannate and the oil of theobroma in a mortar with sufficient chloroform to produce a thin paste, set it aside until the chloroform has evaporated, then incorporate the powdered ingredients, and form a mass with water. Divide this into 100 troches, and dry them in a current of warm air.

Average Dose.—One troche.

TROCHISCI SANTONINI. N. F. Troches of Santonin

(Replacing U. S. P. VIII)

[Troch. Santonin.]

	Metric	Old form
Santonin, in fine powder	3.0 Gm.	46 gr.
Tragacanth, in fine powder	3.0 Gm.	46 gr.
Sugar, in fine powder	54.0 Gm.	1 oz. av. 396 gr.
Cocoa, in fine powder	40.0 Gm.	1 oz. av. 180 gr.
Vanillin, in fine powder	0.1 Gm.	1½ gr.
Water, a sufficient quantity		
To make one hundred troches	100	100

Triturate the vanillin with the santonin and tragacanth until they are thoroughly mixed; then uniformly incorporate the other powders and form a mass with water. Divide this into 100 troches, and dry them in a current of warm air.

Average Dose.—One troche.

TROCHISCI SANTONINI COMPOSITI. N. F. Compound Troches of Santonin

[Troch. Santonin. Co.—TROCHES OF SANTONIN AND CALOMEL.]

	Metric	Old form
Santonin, in fine powder	3.0 Gm.	46 gr.
Mild Mercurous Chloride	3.0 Gm.	46 gr.
Tragacanth, in fine powder	3.0 Gm.	46 gr.
Sugar, in fine powder	51.0 Gm.	1 oz. av. 350 gr.
Cocoa, in fine powder	40.0 Gm.	1 oz. av. 180 gr.
Vanillin	0.1 Gm.	1½ gr.
Water, a sufficient quantity		
To make one hundred troches	100	100

Triturate the vanillin, santonin, and mild mercurous chloride with 20 Gm. [old form 309 grains]of sugar until uniformly mixed, then add the remainder of the sugar and the other ingredients, mix thoroughly and form a mass with water. Divide this into 100 troches, and dry them in a current of warm air.

Average Dose.—One troche.

TROCHISCI SULPHURIS ET POTASSII BITARTRATIS. N. F. Troches of Sulphur and Potassium Bitartrate

[**Troch. Sulphur et Pot. Bitart.**—Troches of Sulphur and Cream of Tartar.]

	Metric	Old form
Washed Sulphur	30.0 Gm.	1 oz. av. 25½ gr.
Potassium Bitartrate	6.0 Gm.	93 gr.
Tragacanth, in fine powder	4.0 Gm.	62 gr.
Sugar, in fine powder	60.0 Gm.	2 oz. av. 51 gr.
Oil of Orange	0.5 mil	8 min.
Water, a sufficient quantity,		
To make one hundred troches	100	100

Triturate the powdered ingredients together until uniformly mixed, then incorporate the oil and form a mass with water. Divide this into 100 troches, and dry them in a current of warm air.

Average Dose.—One troche.

TROCHISCI ULMI. N. F. Troches of Elm

[**Troch. Ulmi**]

	Metric	Old form
Elm, in No. 80 powder	20.0 Gm.	309 gr.
Tragacanth, in fine powder	1.0 Gm.	15 gr.
Sugar, in fine powder	79.0 Gm.	2 oz. av. 344 gr.
Methyl Salicylate	0.2 mil	3 min.
Water, a sufficient quantity,		
To make one hundred troches	100	100

Triturate the powdered ingredients together until uniformly mixed, then incorporate the oil and form a mass with water. Divide this into 100 troches, and dry them in a current of warm air.

Average Dose.—One troche.

Confectiones *Confections*

Confections are saccharine, soft solids, in which one or more medicinal substances are incorporated with the object of affording an agreeable form for their administration, and a convenient method for their preservation. Under the old names of *conserves* and *electuaries,* these preparations have been in use for centuries. In the preparation of confections the basis is finely powdered sugar, and the medicinal ingredients must be brought to the condition of a smooth paste or introduced as a fine powder or liquid. Two confections are official in the N. F.

N. F. Confections

Confectio Rosæ	80 Gm. Red Rose, in No. 60 powder; 640 Gm. Powdered Sugar; 120 Gm. Clarified Honey; 160 mils Stronger Rose Water
Sennæ	100 Gm. Senna, in No. 60 powder; 5 Gm. Oil of Coriander; 160 Gm. Cassia Fistula, bruised; 100 Gm. Tamarind; 70 Gm. Prune; 120 Gm. Fig, bruised; 555 Gm. Powdered Sugar; Water, sufficient to make 1000 Gm.

Unofficial Confections

Name	Ingredients	Preparation
Confectio Guaiaci Composita B. P. C.	1 Gm. Guaiac Resin; 2 Gm. Rhubarb powdered; 7.5 Gm. Acid Potassium Tartrate; 1 Gm. powdered Nutmeg; 14.5 Gm. Sublimed Sulphur; 74 Gm. Purified Honey	Mix the powders together and form a mass by means of the Clarified Honey
Piperis. Br.	100 Gm. Black Pepper; 150 Gm. Caraway Fruit; 750 Gm. Purified Honey	Mix them and form into a mass
Sulphuris. Br.	450 Gm. Precipitated Sulphur; 110 Gm. Acid Potassium Tartrate; 5 Gm. Tragacanth; 210 mils Syrup; 55 mils Tincture of Orange; 170 mils Glycerin	Mix them and form into a mass

CONFECTIO ROSÆ. N. F. Confection of Rose

(U. S. P. VIII)

[Confect. Ros.]

	Metric	Old form
Red Rose, in No. 60 powder	80 Gm.	2 oz. av. 245 gr.
Sugar, in fine powder	640 Gm.	20 oz. av. 210 gr.
Clarified Honey	120 Gm.	3 oz. av. 367 gr.
Stronger Rose Water	160 mils	5 fl. oz. 52 min.
To make about	1000 Gm.	32 oz. av.

Rub the red rose with the stronger rose water previously heated to 65° C. (149° F.), then gradually add the sugar and clarified honey, and knead it until a uniform mass is obtained.

CONFECTIO SENNÆ. N. F. Confection of Senna

(U. S. P. VIII)

[Confect. Senn.]

	Metric	Old form
Senna, in No 60 powder	100 Gm.	3 oz. av. 87½ gr.
Cassia Fistula, bruised	160 Gm.	5 oz. av. 52 gr.
Tamarind	100 Gm.	3 oz. av. 87½ gr.
Prune, sliced	70 Gm.	2 oz. av. 105 gr.
Fig, bruised	120 Gm.	3 oz. av. 363 gr.
Sugar, in fine powder	555 Gm.	17 oz. av. 328 gr.
Oil of Coriander	5 Gm.	70 gr.
Water, a sufficient quantity,		
To make	1000 Gm.	32 oz. av.

Digest the cassia fistula, tamarind, prune, and fig with 500 mils [old form 1 pint] of water in a covered vessel, on a water bath, for three hours. Rub the pulpy mass, first through a coarse sieve, and then through a muslin cloth. Mix the residues with 150 mils [old form 4 fluidounces, 384 minims] of water, digest the mixture for a short time, then treat it as before, and add the strained product to the pulpy mass first obtained. Then, by means of a water bath, dissolve the sugar in the mixture, and evaporate it, in a tared vessel, until it weighs 895 Gm. [old form 29 ounces av., 384 grains]. Lastly, add the senna and the oil of coriander, and incorporate them thoroughly with the other ingredients while they are yet warm.

Average Dose.—Sixty grains (4 Gm.).

Massæ *Masses*

Pill masses are official in the U. S. Pharmacopœia under the title of "Massa." As the official preparations are usually kept in bulk by pharmacists, and are permanent preparations, there is a manifest propriety in making a distinct class of them. There are *two* official masses.

U. S. P. Masses

Name	Proportions	Preparation
Massa Ferri Carbonatis	100 Gm. Ferrous Sulphate; 46 Gm. Monohydrated Sodium Carbonate; 38 Gm. Clarified Honey; 25 Gm. Sugar, in coarse powder; Syrup and Distilled Water, of each, a sufficient quantity to make 100 Gm.	Dissolve the Ferrous Sulphate and the Monohydrated Sodium Carbonate separately in boiling Distilled Water, add 20 mils Syrup to the Solution of Ferrous Sulphate, and mix the solutions. When cold, pour off the supernatant liquid, and wash the precipitate with a mixture of 1 volume of Syrup to 19 volumes of Water. Drain the precipitate, mix it with the Honey and Sugar, and evaporate it to 100 Gm.
Hydrargyri	33 Gm. Mercury; 1 Gm. Oleate of Mercury; 10 Gm. Glycyrrhiza, powdered; 15 Gm. Althæa, powdered; 9 Gm. Glycerin; 32 Gm. Honey of Rose	Triturate the Oleate of Mercury in a warm mortar, gradually add the Mercury, then introduce a small amount of Honey of Rose and triturate the mixture until globules of Mercury are no longer visible under a lens magnifying ten diameters. Now incorporate the remainder of the Honey of Rose and the Glycerin, then gradually add the Glycyrrhiza and Althæa and continue the trituration until the mass is homogeneous

N. F. Mass

Name	Ingredients	Preparation
Massa Copaibæ. (See page 1181)	94 Gm. Copaiba; 6 Gm. Magnesium Oxide; Water, a sufficient quantity	Uniformly dampen the Magnesia with a little Water, gradually incorporate the Copaiba with it, and heat on a water-bath, during half an hour, frequently stirring. Lastly, set it aside until it has acquired a pilular consistence

MASSA FERRI CARBONATIS. U. S. Mass of Ferrous Carbonate

[**Mass. Ferr. Carb.**—Vallet's Mass]

It contains not less than 35 per cent. of $FeCO_3$ (115.84).

	Metric	Old form
***Ferrous Sulphate**	100 Gm.	8 oz. av.
Monohydrated Sodium Carbonate	46 Gm.	3 oz. av. 298 gr.
Clarified Honey	38 Gm.	3 oz. av.
Sugar, in coarse powder	25 Gm.	2 oz. av.
Syrup,		
Distilled Water, each, a sufficient quantity,		
To make	100 Gm.	8 oz. av.

Dissolve the ferrous sulphate and the monohydrated sodium carbonate, each separately, in 200 mils [old form 1 pint] of boiling distilled water, and, having added 20 mils [old form 1½ fluidounces] of syrup to the solution of the iron salt, filter both solutions, and allow them to become cold. Place the solution of monohydrated sodium carbonate in a bottle having a capacity of about 500 mils [old form about 2½ pints], and gradually add the solution of the iron salt, rotating the bottle frequently, until carbonic acid gas no longer escapes. Add sufficient distilled water to fill the bottle; then cork it and set it aside, so that the ferrous carbonate may subside. Pour off the supernatant liquid, and, having mixed syrup and distilled water in the proportion of 1 volume of syrup to 19 volumes of distilled water, wash the precipitate with the mixture by decantation until the washings no longer have a saline taste. Drain the precipitate on a muslin strainer, and express as much of the water as possible. Lastly, mix the precipitate at once with the clarified honey and sugar, and, by means of a water bath, evaporate the mixture in a tared dish, with constant stirring, until it is reduced to 100 Gm. [old form 8 oz. av.].

Assay.—Dissolve about 1 Gm. of Mass of Ferrous Carbonate, accurately weighed, in 15 mils of diluted sulphuric acid, dilute the solution with distilled water to about 100 mils and immediately titrate with tenth-normal potassium dichromate V. S., potassium ferricyanide T.S. being used as indicator. It shows not less than 35 per cent. of $FeCO_3$.

Each mil of tenth-normal potassium dichromate V.S. used corresponds to 0.011584 Gm. of $FeCO_3$. Each gramme of Mass Ferrous Carbonate corresponds to not less than 30.2 mils of tenth-normal potassium dichromate V.S.

Average Dose.—Four grains (0.25 Gm.).

MASSA HYDRARGYRI. U. S. Mass of Mercury

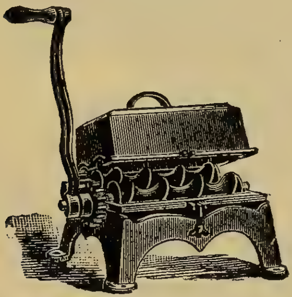
[**Mass. Hydrarg.**—BLUE MASS BLUE PILL]

It contains not less than 32 per cent. nor more than 34 per cent. of Hg. Preserve the product in well-closed containers.

	Metric	Old form
***Mercury**	33 Gm.	5 oz. av. 122 gr.
Oleate of Mercury	1 Gm.	70 gr.
Glycyrrhiza, in No. 60 powder	10 Gm.	1 oz. av. 262 gr.
Althæa, in No. 60 powder	15 Gm.	2 oz. av. 175 gr.
Glycerin	9 Gm.	1 oz. av. 193 gr.
Honey of Rose	32 Gm.	5 oz. av. 53 gr.
To make	100 Gm.	16 oz. av.

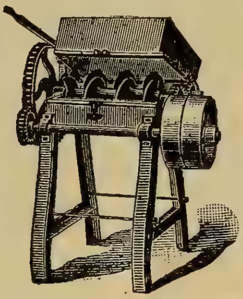
Triturate the oleate of mercury in a warm mortar, gradually add the mercury, then introduce a small amount of honey of rose and triturate the mixture until globules of mercury are no longer visible under a lens magnifying ten diameters. Now incorporate the remainder of the honey of rose and the glycerin, then gradually add the glycyrrhiza and althæa and continue the trituration until the mass is homogeneous.

FIG. 696



Day's pill mass mixer

FIG. 697



Day's pill mass mixer

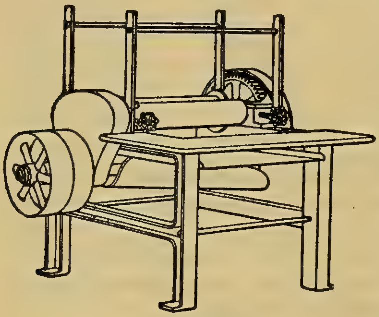
Assay.—Place about 0.5 Gm. of Mass of Mercury, accurately weighed, in a porcelain dish, add 10 mils of sulphuric acid, heat on a water bath for ten minutes, then add 10 mils of nitric acid and heat the mixture on a sand bath, adding small portions of nitric acid, if necessary, until a colorless or nearly colorless solution results. Now add potassium permanganate T.S. to the hot solution until the red color persists, then discharge the color by the addition of just sufficient oxalic acid T.S. Wash the solution into a flask with distilled water, dissolve any insoluble residue by the addition of nitric acid, dilute the solution to about 150 mils, add 2 mils of ferric ammonium sulphate T.S. and titrate the solution with tenth-normal potassium sulphocyanate V.S. to the production of a pink tint. It shows not less than 32 per cent. nor more than 34 per cent. of Hg.

Each mil of tenth-normal potassium sulphocyanate V.S. used corresponds to 0.01003 Gm. of Hg. Each gramme of Mass of Mercury corresponds to not less than 31.9 nor more than 33.9 mils of tenth-normal potassium sulphocyanate V.S.

Average Dose.—Four grains (0.25 Gm.).

Apparatus for Kneading Masses.—In making masses upon the large scale it is necessary to use mechanical contrivances to secure a thorough admixture of the various ingredients. One of the simplest forms consists of two smooth iron rollers, geared so that they may be made to approach or recede from each other, revolving in opposite directions and at slightly different rates of speed. The mass roughly mixed is repeatedly passed through the rollers, which may be hollow, so that steam can be introduced inside and thus heated (some masses requiring such treatment). Figs. 696 and 697 illustrate two forms of Day's pill mass mixer. Fig. 696 represents a hand machine having a capacity of three pounds, and Fig. 697 one intended to be run by "power," with a capacity of thirty pounds. They are made of iron and steel, the hoppers are lined with porcelain, and the machine is arranged so that the mass can be discharged, when finished, by inclining the machine and revolving the mixers.

Fig. 698



Day's pill mass rollers

Another form of mixer made by the J. H. Day Company is shown in Fig. 698. It is especially designed to incorporate mixtures of extracted matter for pill masses; two steel rollers, which can be set so as to revolve at different distances apart, are secured to a strong iron frame, the operator places the moistened materials that are to be mixed between the rollers, and by continually returning the mass which drops below, it is thoroughly kneaded. Fig. 699 shows Colton's mass mixer. It is constructed for heavy work.

Pilulæ *Pills*

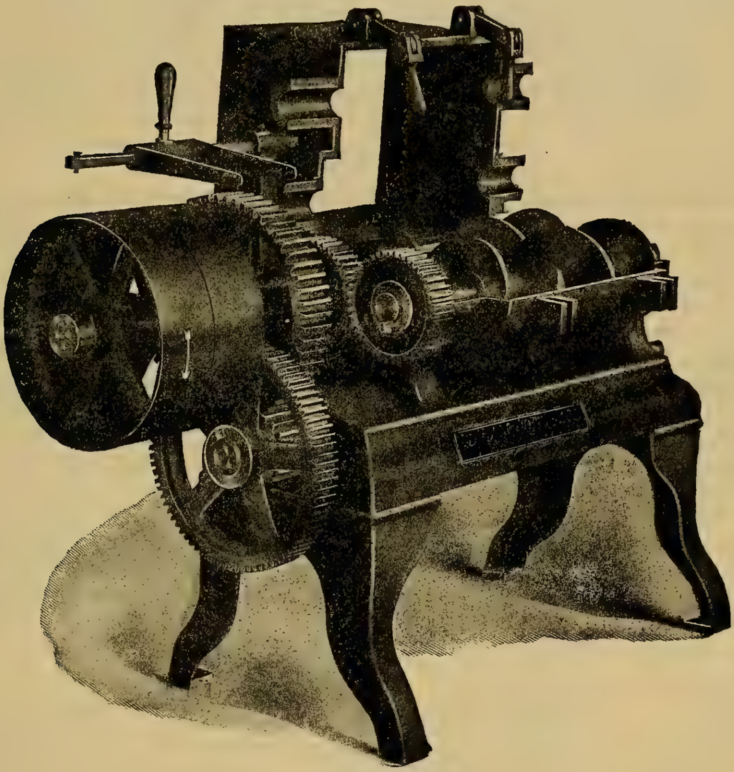
Pills are small, solid bodies, of a globular, ovoid, or lenticular shape, which are intended to be swallowed and thereby produce medicinal action. Pills are more largely used than any other form of solid preparations. Substances which are bitter or unpleasant to the taste, if not corrosive or deliquescent, can be administered in this form if the dose is not too large. The ease and rapidity with which pills can be administered, the length of time during which they retain their original activity, their compact form, and their absence of unpleasant taste when coated, are the principal reasons for their extended use.

In order to give medicinal substances the requisite shape and consistence to form pills, they must be brought into a soft condition and made into a mass, generally through the use of a volatile liquid. The subsequent evaporation of this liquid, or a portion of it, should produce but little change in the form of the pill. As previously stated (page 1733), pill masses are sometimes kept in bulk and made into pills when occasion requires. By far the greatest number, however, are made extemporaneously, and the exercise of the knowledge and perception which are necessary in selecting the proper substance to form the mass constitutes one of the most important duties of the pharmacist. To be able always to select the proper excipient requires a thorough knowledge of the physical properties of all the articles of the materia medica which enter into the composition of pill masses.

Forming the Mass.—The mass consists of two parts: 1. The active ingredients. 2. The excipient, or the substance used to form the mass and give it the proper consistence. The essential requirements of a pill mass are: 1. *Adhesiveness.* 2. *Firmness.* 3. *Plasticity.*

1. **Adhesiveness.**—The mass must be sufficiently adhesive to retain its shape and yet be soft enough to be worked by the fingers or suitable apparatus into the desired form. To enable it to possess adhesiveness, a liquid is usually added to the powdered ingredients, and the selection of this liquid must always depend upon the physical character of the ingredients; in many cases the latter possess sufficient adhesiveness in themselves if they are moistened with water, and hence the quality is *only developed,*—not created, as in the case of powders containing extracts; others, again, are totally devoid of adhesiveness, and sticky substances, like gum, sugar, etc., must be added in sufficient quantity to supply the deficiency. Some substances may be made

FIG. 699



Colton's mass mixer

soft and adhesive by simply heating them, and they regain their original condition when allowed to cool.

2. **Firmness.**—The mass must possess sufficient firmness to permit the pills to retain their shape. The condition of adhesiveness is usually dependent upon the addition of a liquid which dissolves *a small portion* of the solid ingredients, and this solution is adhesive enough to enable the mass to be made; but if too much liquid be added, the quality of firmness will be lost, and the pills either cannot be formed at all, or will subsequently run together in the box. The physical properties of the active ingredients of the pill must be thoroughly understood to judge of the proper quantity and kind of excipient to be used to give adhesiveness without losing firmness. The following general rule may serve to guide the operator: *Never use an excipient alone which is a perfect solvent for the solid substances.* For instance, water should not be used *alone* for making pills of the *soluble* scaled iron salts; for, although the pills may apparently be firm enough when dispensed, they will be very apt in warm weather to run together in the box. If sufficient acacia be used with the water, they can be made to retain their shape.

3. **Plasticity.**—The condition of plasticity is a natural result of the possession of a proper degree of adhesiveness and firmness. Many substances may be formed into a mass which will be either adhesive or firm, but unless these conditions are properly balanced, so that the mass can be quickly and easily formed into pills which will retain their shape without flattening, pills cannot be made successfully. Plasticity can generally be secured by thoroughly working or kneading the mass. In this connection see Fig. 484. The choice of excipient is usually left entirely to the pharmacist, and in making the selection care should be taken that, while the pharmaceutical requirements are fulfilled, the proper solubility or disintegrability of the pill in the stomach is not lost sight of.

Choice of the Excipient.—An examination of the following list of excipients will probably convey a good idea of their uses. They are divided into two classes, liquid and solid. Liquid excipients are generally preferred, because they are more conveniently added to the powders:

List of Excipients

Liquid

Water	Used only when the ingredients of the pill possess sufficient adhesiveness to be developed by the water
Syrup	An excellent excipient when more adhesiveness is needed than can be afforded by the use of water
Syrup of Acacia	Better than syrup, because it is more adhesive, and can be used in smaller quantity. The objection to its use is that the pills made with it are apt to become very hard, and in some cases they may be practically insoluble in the liquids of the stomach
Mucilage of Acacia	More adhesive than any of the preceding, but open to the same objection as syrup of acacia
Glycerin	Somewhat adhesive, but very valuable, because its hygroscopic properties prevent the pills made with it from becoming hard. It is rarely advisable to use it alone, however, as the surfaces of the pills often acquire a dampness which attracts the particles of dusting powder
Glucose	A very valuable excipient. It is colorless, very adhesive, and practically non-volatile at ordinary temperatures
Honey	May be used in place of glucose for dark colored masses, but quinine pills are not white when honey is used as the excipient
Extract of Malt	Has the advantages of glucose, but the disadvantage of honey in not being colorless

List of Excipients—*Continued*

Liquid

Glycerite of Starch	Possesses the merits of glycerin, with the adhesiveness of the starch jelly. Its thick consistence is sometimes an inconvenience
Glycerite of Tragacanth	Similar to glycerite of starch
General Excipient	Suggested by the author as combining the advantages of several of the above (see below)

Solid

Confection of Rose	Useful when a small quantity of an active ingredient is to be made into pills and dilution is necessary, as in pills of strychnine, podophyllin, etc. Its bulkiness is its principal disadvantage for general work
Crumb of Bread (Mica panis)	Valuable for very powerful liquids, like croton oil, volatile oils, etc.
Powdered Althæa	Gives adhesiveness, and is useful as an absorbent, but is bulky
Soap	A very valuable excipient for resinous substances. It increases their solubility, and forms an unexceptionable mass
Rosin Cerate	Valuable for oxidizable substances, resins, etc.
Cacao Butter	Used for pills of potassium permanganate and similar substances
Petrolatum	Used for oxidizable substances like the two preceding excipients

GENERAL EXCIPIENT FOR PILLS

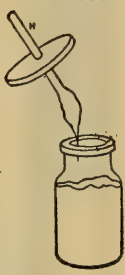
The following excipient is recommended as possessing several advantages. It is a colorless, permanent, very adhesive liquid; the pills made with it are small; and the proportion of glycerin is not large enough to make the surfaces of the pills hygroscopic in an ordinary atmosphere:

Glucose (syrupy)	**4 oz. av.**
Glycerin	**1 oz. av.**
Acacia (powdered, best)	**90 grains**
Benzoic Acid	**1 grain**

Dissolve the Benzoic Acid in the Glycerin contained in a small tared capsule, add the Acacia with stirring, and then the Glucose, and allow the mixture to stand until the Acacia is dissolved. A *moderate* heat may be applied to hasten solution. The benzoic acid is used as an antiseptic; if the excipient is made in small quantities and frequently, the benzoic acid may be omitted.

In Fig. 700 a simple but effective excipient bottle is shown. It is made from a plain morphine bottle; a piece of sheet rubber cloth, such as is used for making washers, is cut into a disk, slightly larger in diameter than the mouth of the bottle; a hole in the centre permits the introduction of a round, slightly tapering wooden rod, H, or, if preferred, a solid glass rod. It is obvious that as the excipient is used the rod may be slipped down so as always to dip into the excipient a certain distance, and thus the quantity adhering to the end can be easily adjusted. One of the merits of this simple device is that all parts of it can be easily renewed and kept clean.

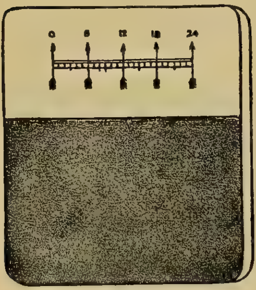
FIG. 700



Excipient bottle

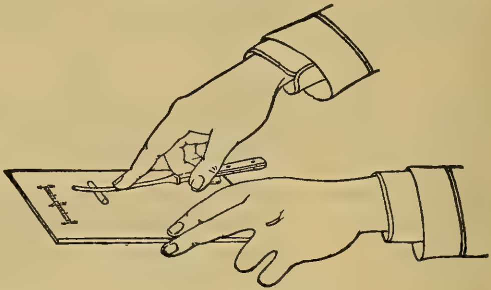
Dividing the Mass.—Upon the small scale the pill tile may be used for this operation (see Fig. 701). This is usually made of queen's ware or porcelain. The objection to this material, however, is that some substances will penetrate through the little fissures in the tile and soil it. These are often very difficult to dislodge, and they usually give the tile a dirty appearance, in spite of the most diligent washing. A few years since, the Whitall Tatum Company made, at the author's suggestion, a pill tile from plate glass, having the scale graduated by an engraver's wheel, and a little over one-half of its surface ground so that the pill cylinder would not slip. This makes an unexceptionable surface. The pill mass is placed upon the tile and rolled into a cylinder, either with a smooth, flat board or a spatula, as shown in Fig. 702. It is then placed upon the graduated scale and cut with the spatula into the desired number of pieces; these are afterwards rolled between the fingers into globular pills.

Fig. 701



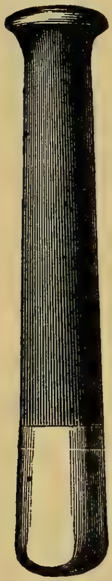
Pill tile

Fig. 702



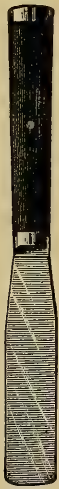
Rolling the pill cylinder

Fig. 703



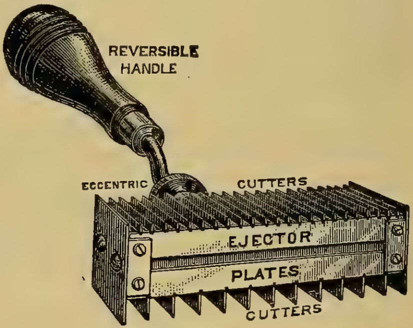
Pill pestle

Fig. 704



Pill spatula

Fig. 705



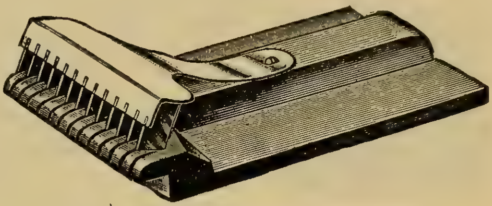
Michael's pill cutter

Fig. 703 illustrates a form of pill pestle specially made for kneading a mass in a mortar.

Fig. 704 shows a pill spatula; it has very little "spring," and the end is broad. It is useful in making a mass in a mortar as well as in rolling a pill cylinder. Ordinary steel ointment spatulas, which have the ends broken off or otherwise injured, can often be cut with a three cornered file, and the edge smoothed and made into a serviceable pill spatula.

Fig. 705 shows Michael's pill cutter; it will cut the cylinder into twelve or twenty-four pills at once; by reversing the handle it can be used for making pills of a different size. The Diamond pill cutter is shown in Fig. 706; the pill cylinder is placed under the projecting wooden cross piece, and the metal cutters pressed down upon it; the pieces are then rounded into shape with the fingers.

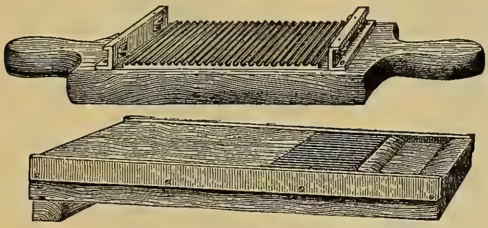
FIG. 706



Diamond pill cutter

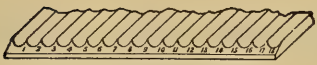
Pill machines are preferred in making larger quantities of pills; indeed, many pharmacists never use a pill tile, but divide and cut all their pills with a machine. This consists of two hard wood boards, one of which is encased in a metal frame (to prevent warping); a brass plate having hemispherical grooves is fastened to one end of the lower board, and a similar plate is adjusted to the upper board, which is furnished with handles at the end; brass guides are attached to the upper board, to cause the cutting surfaces of the grooves on both boards to correspond (see Figs. 707, 708). The pill mass is rolled into a cylinder and laid upon the grooves of the lower board; the upper board is then applied so that the cutting surfaces correspond with those of the lower board, and, by a slight backward and forward motion with downward pressure, the mass is divided.

FIGS. 707, 708



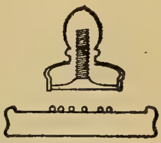
Pill machine

FIG. 709



Pill cutter (numbered edge)

FIG. 710

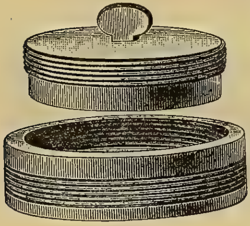


Pill finisher

When a smaller number of pills are needed than the full capacity of the cutters indicates, the cylinder is rolled out merely to the length necessary to make the desired quantity. In using the pill machine in this way a common annoyance is experienced, however, in having either to count off the number of grooves each time, or to deface the board with lines. The simple expedient proposed by the author in 1875, and shown in Fig. 709, obviates this. The lower cutter is removed from the board, and its edge is bevelled off so that sufficient space may be gained to stamp a small figure below each cutting edge. Pill machines with this addition may be had from A. H. Wirz, of Philadelphia. The Cooper pill machine is so constructed that but one lower and one upper board are necessary for making several sizes of pills. This object is effected by making the cutters for the various sizes removable and adjustable.

Dusting Powder.—To prevent the pill cylinder from sticking to the board or tile, and to lessen the friction, some absorbent powder is dusted upon the surfaces. This may be rice flour, powdered magnesium carbonate, lycopodium, powdered althæa, or powdered licorice root. Rice flour is preferable for white pills, because its presence is not easily recognized, and because the cylinder does not slip, as it usually does when lycopodium is used.

Fig. 711



Pill finisher

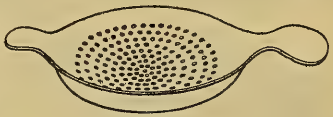
Finishing the Pills.—Many efforts have been made to supply effective mechanical devices for finishing pills, yet the fact remains that the pharmacist usually prefers to roll and finish them with his fingers. If a finisher is desired, a level surface having a raised rim may be used, and the pills enclosed and rotated by the adjustable pill finisher shown in Fig. 710.

Fig. 711 shows another form of pill finisher; it is made of metal.

In Fig. 712 is seen a pill sifter; it is made of horn and perforated with holes. Pills which are moist are placed in a dusting powder, and when the surface moisture has been absorbed, they are thrown upon the sifter and shaken about gently until freed from adhering superfluous powder.

When large quantities of pills are made, they are usually dried by rolling them in some absorbent powder, spreading them out, and exposing them to dry air.

Fig. 712

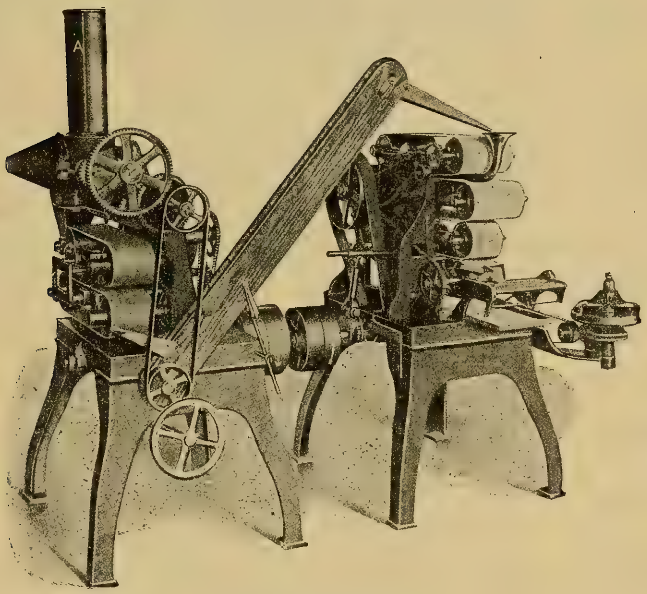


Horn pill sifter

In Fig. 713 is shown a machine for making pills, manufactured by Arthur Colton, of Detroit. It is, of course, complicated; but when the great number of operations that are required in making pills is considered, the results achieved by this apparatus are marvellous. The illustration shows two machines; the one on the left, called the ball making machine, makes the mass homogeneous, and delivers it covered with dusting powder in the shape of balls into the hopper of the machine on the right, which is known as the *Automata*. As each ball is thus delivered to the piping belts of the Automata, a series of operations immediately begins; as it rapidly advances through and toward its destination, it becomes elongated into a strip or pipe; it is rolled many hundred times about its own diameter, and a gentle pressure is given to it as it advances between the belts, sustained from two points of contact; when the pipe is finished, it will have passed through the entire pathway designed for piping, when it now drops on to revolving cutters, where it is divided into pieces of uniform size and weight; these pieces thus cut, drop on to a chute, which conveys them to the entrance of the pill rounding belts; when once drawn in, and between these belts, they are thoroughly rolled, each advancing forward, and by many hundreds side by side, as they go whirling through the automatic finisher; they are now hastened onward until they reach the separator, where a system of sorting is carried on, by which eventually the good pills are retained, and the tailings are rejected. It is possible to make, with the No. 0 automatic pill machine, 864,000 two-grain pills in ten hours' time.

Friable Pills.—The so-called *friable* or *pulverous pills* are made in pill-coating pans by starting with a uniformly granulated sugar obtainable from candy supply houses. This is placed in the revolving pan, sprayed from an atomizer with melted cocoanut oil or liquid petrolatum, then the desired medication is added in very fine powder by sifting it upon the moist granules without heat. This treatment is alternated until pills of proper weight are built up. These may be afterwards coated and polished and their peculiarity consists in the ease with which they may be crushed to a fine powder, usually between the thumb and finger.

FIG. 713



Colton's modern pill plant

Dispensing Pills.—Pills are usually dispensed in flat, circular boxes. These should be made so shallow that the pills cannot lie on top of one another. Square pill boxes are coming into use, and are preferred to round boxes for several reasons, the principal one being that a square label can be used. This can be trimmed more neatly and quickly than a round label, and, in the opinion of many pharmacists of taste, looks better. A small quantity of dusting powder should be placed in the box to prevent the adhesion of freshly made pills.

U. S. P. Pills

Pilulæ Aloes	Made by forming a mass, with the aid of water, from 13 Gm. of Aloes and 13 Gm. of Soap, and dividing it into 100 pills
Asafœtidæ	Made by forming a mass, with the aid of water, from 20 Gm. of Asafætida and 6 Gm. of Soap, and dividing it into 100 pills
Catharticæ Compositæ	Made by forming a mass, with the aid of Diluted Alcohol, from 80 Gm. of Compound Extract of Colocynth, 60 Gm. of Mild Mercurous Chloride, 20 Gm. of Resin of Jalap, and 15 Gm. of Gamboge, and dividing the mass into 1000 pills
Ferri Carbonatis	Made by rubbing 8 Gm. of Potassium Carbonate with about 10 drops each of Glycerin and Water, then adding 16 Gm. of Granulated Ferrous Sulphate which has been previously mixed with 4 Gm. of Sugar, and triturating the whole until the reaction has terminated. Finally add 1 Gm. each of powdered Tragacanth and Althæa and enough more water to form a mass, and divide it into 100 pills
Ferri Iodidi	Made by triturating together 4 Gm. of Reduced Iron, 6 mils of Water, and 5 Gm. of Iodine, until the liquid ceases to have a reddish tint, then adding 4 Gm. of Glycyrrhiza, 4 Gm. of Sugar, and 1 Gm. each of Extract of Glycyrrhiza and Acacia (all in fine powder and thoroughly mixed), evaporating the mass until it has acquired a pilular consistence, and then dividing it into 100 pills, and finally coating the pills with a solution made by dissolving 10 Gm. of Balsam of Tolu in 15 mils of Ether
Phosphori	Made by dissolving 0.06 Gm. of Phosphorus in 5 mils of Chloroform with the aid of a little heat, adding the solution to 6 Gm. of Althæa and 3 Gm. of Acacia, forming a mass, with the aid of a mixture of Glycerin 2 parts and Water 1 part, and dividing it into 100 pills, and finally coating the pills with a solution prepared by dissolving 10 Gm. of Balsam of Tolu in 15 mils of Ether
Rhei Compositæ	Made by forming a mass, with the aid of Water, from 13 Gm. of powdered Rhubarb, 10 Gm. of Aloes, 6 Gm. of powdered Myrrh, and 0.5 mil of Oil of Peppermint, and dividing it into 100 pills

N. F. Pills

Pilulæ ad Prandium Chapman's	Made by forming a mass by the aid of Diluted Alcohol from 9.7 Gm. of Aloes, 9.7 Gm. of Mastic, 6.5 Gm. of Ipecac and 1.5 mils of Oil of Fennel and dividing into 100 pills
Cole's	Made by forming a mass by the aid of Syrup from 7.8 Gm. of Aloes, 7.8 Gm. of Mass of Mercury, 7.8 Gm. of Jalap and 0.13 Gm. of Antimony and Potassium Tartrate and dividing into 100 pills
Hall's	Made by forming a mass by the aid of Syrup from 6.5 Gm. of Aloes, 6.5 Gm. Extract of Glycyrrhiza, 6.5 Gm. of Soap and dividing into 100 pills
Aloes et Asafœtidæ	Made by forming a mass by the aid of water from 9 Gm. of Purified Aloes, 9 Gm. of Asafetida, 9 Gm. of powdered Soap, and dividing into 100 pills
Aloes et Ferri. U. S. P. VIII	Made by forming a mass, with the aid of Confection of Rose, from 7 Gm. each of Aloes, Exsiccated Ferrous Sulphate, and Aromatic Powder, and dividing it into 100 pills
Aloes et Mastiches. U. S. P. VIII	Made by forming a mass, with the aid of Diluted Alcohol, from 13 Gm. of Aloes, 4 Gm. of Mastic, and 3 Gm. of Red Rose, and dividing it into 100 pills
Aloes et Myrrhæ. U. S. P. VIII	Made by forming a mass, with the aid of Syrup, from 13 Gm. of Aloes, 6 Gm. of Myrrh, and 4 Gm. of Aromatic Powder, and dividing it into 100 pills
Aloes et Podophylli Compositæ	Made by forming a mass by the aid of the pilular extract from 6.5 Gm. of Aloes, 3.25 Gm. Resin of Podophyllum, 1.6 Gm. of Pilular Extract of Belladonna Leaves and 1.6 Gm. of Extract Nux Vomica and dividing into 100 pills
Aloes, Hydrargyri et Podophylli	Made by uniformly mixing and forming a mass from 13 Gm. of Aloes, 6.5 Gm. of Mass of Mercury and 1.6 Gm. of Resin of Podophyllum and dividing into 100 pills
Aloes, Hydrargyri et Scammonii Compositæ	Made by uniformly mixing and forming a mass by the aid of Tincture of Aloes and Myrrh from 5.5 Gm. of Aloes, 5.5 Gm. of Resin of Scammony, 5.5 Gm. of Mass of Mercury, 0.32 mil of Croton Oil and 1.6 mils of Oil of Caraway and dividing into 100 pills
Aloini Compositæ	Made from 3.25 Gm. of Aloin, 0.8 Gm. of Resin of Podophyllum and 1.6 Gm. of Pilular Extract of Belladonna Leaves and dividing into 100 pills
Aloini, Strychninæ et Belladonnæ	Made from 1.3 Gm. of Aloin, 0.05 Gm. of Strychnine, and 0.8 Gm. of Pilular Extract of Belladonna and dividing into 100 pills
Aloini, Strychninæ et Belladonnæ Compositæ	Made by forming a mass from 1.3 Gm. of Aloin, 0.05 Gm. of Strychnine, 0.8 Gm. of Pilular Extract of Belladonna Leaves and 3.25 Gm. of Extract Cascara Sagrada and dividing into 100 pills
Antidyspepticæ	Made by forming a mass from 0.16 Gm. of Strychnine, 0.65 Gm. of Ipecac, 0.65 Gm. of Pilular Extract of Belladonna Leaves, 13 Gm. of Mass of Mercury and 13 Gm. of Compound Extract of Colocynth and dividing into 100 pills
Antimonii Compositæ	Made by forming a mass by the aid of Castor Oil from 4 Gm. of Sulphurated Antimony, 4 Gm. of Mild Mercurous Chloride, 8 Gm. Guaiac, and dividing into 100 pills
Antiperiodicæ	Made by forming a mass by the aid of Extract of Gentian from 6.5 Gm. of Extract of Aloes, 3.2 Gm. of Rhubarb, 3.2 Gm. of Angelica Fruit, 1.6 Gm. of Inula, 1.6 Gm. of Saffron, 1.6 Gm. of Fennel, 0.8 Gm. of Zedoary, 0.8 Gm. of Cubeb, 0.8 Gm. of Myrrh, 0.8 Gm. of Agaric, 0.8 Gm. of Camphor, and 9 Gm. of Quinine Sulphate and dividing into 100 pills

N. F. Pills—*Continued*

Pilulæ Antiperiodicæ sine Aloe	Prepare the Pills as directed under Pilulæ Antiperiodicæ, omitting the Extract of Aloes
Catharticæ Vegetabiles U. S. P. VIII	Made by forming a mass, with the aid of Diluted Alcohol, from 6 Gm. of Compound Extract of Colocynth, 3 Gm. of Extract of Hyoscyamus, 2 Gm. of Resin of Jalap, 1.5 Gm. of Extract of Leptandra, 1.5 Gm of Resin of Podophyllum, and 0.8 mil of Oil of Peppermint, and dividing it into 100 pills
Colocynthidis Compositæ	Made by forming a mass by the aid of Diluted Alcohol from 1.1 Gm. Extract of Colocynth, 13 Gm. of Aloes, 13 Gm. of Resin of Scammony, and 1.5 mils of Oil of Clove and dividing into 100 pills
Colocynthidis et Hyoscyami	Made by forming a mass from 0.65 Gm. of Extract of Colocynth, 9.7 Gm. of Aloes, 9.7 Gm. of Resin of Scammony, 9.7 Gm. of Extract of Hyoscyamus and 1 mil of Oil of Clove and dividing into 100 pills
Colocynthidis et Podophylli	Made by forming a mass by the aid of Syrup from 16.2 Gm. of Compound Extract of Colocynth and 1.6 Gm. of Resin of Podophyllum and dividing into 100 pills
Digitalis, Scillæ et Hydrargyri	Made by forming a mass by the aid of Clarified Honey from 6.5 Gm. of Digitalis, 6.5 Gm. of Squill, and 6.5 Gm. of Mass of Mercury and dividing into 100 pills
Ferri, Quininæ, Aloes et Nucis Vomicæ	Made by forming a mass by the aid of Extract of Gentian from 6.5 Gm. of Exsiccated Ferrous Sulphate, 6.5 Gm. of Quinine Sulphate, 6.5 Gm. of Aloes, and 1.6 Gm. of Extract of Nux Vomica and dividing into 100 pills
Ferri, Quininæ, Strychninæ et Arseni Fortiores	Made by forming a mass by the aid of Clarified Honey from 6.5 Gm. of Reduced Iron, 6.5 Gm. of Quinine Sulphate, 0.32 Gm. of Strychnine and 0.32 Gm. of Arsenic Trioxide and dividing into 100 pills
Ferri, Quininæ, Strychninæ et Arseni Mites	Made by forming a mass by the aid of Clarified Honey from 4.5 Gm. of Reduced Iron, 6.5 Gm. of Quinine Sulphate, 0.13 Gm. of Strychnine and 0.13 Gm. of Arsenic Trioxide and dividing into 100 pills
Glycerylis Nitratis	Made by mixing 6.5 Gm. of Spirit of Glyceryl Trinitrate with 6.5 Gm. of Althæa, exposing to the air to allow the alcohol to evaporate, then massing with Confection of Rose and dividing into 100 pills
Laxativæ Compositæ	Made by forming a mass, with the aid of Syrup, from 1.3 Gm. of Aloin, 0.05 Gm. of Strychnine, 0.8 Gm. of Extract of Belladonna Leaves, 0.4 Gm. of Ipecac, and 4.6 Gm. of Glycyrrhiza, and dividing it into 100 pills
Laxativæ Post Partum	Made by forming a mass by the aid of Diluted Alcohol from 11 Gm. of Compound Extract of Colocynth, 5.5 Gm. of Aloes, 2.5 Gm. of Extract of Nux Vomica, 0.5 Gm. of Resin of Podophyllum, 0.5 Gm. of Ipecac, and 8 Gm. of Extract of Hyoscyamus and dividing into 100 pills
Opii, Digitalis et Quininæ	Made by forming a mass by the aid of Clarified Honey from 1 Gm. of Powdered Opium, 6.5 Gm. of Digitalis, and 6.5 Gm. of Quinine Sulphate and dividing into 100 pills
Opii et Camphoræ	Made by forming a mass by the aid of Clarified Honey from 6.5 Gm. of Powdered Opium, and 13 Gm. of Camphor and dividing into 100 pills
Opii et Plumbi	Made by forming a mass by the aid of Clarified Honey from 6.5 Gm. of Powdered Opium, and 6.5 Gm. of Lead Acetate and dividing into 100 pills
Rhei	Made by forming a mass by the aid of Water from 20 Gm. of Rhubarb, and 6 Gm. of Soap and dividing into 100 pills

Unofficial Pills

Name	Ingredients	Preparation
Pilula Cambogiæ Composita Br. 1898	25 Gm. Gamboge; 25 Gm. Barbados Aloes; 25 Gm. Compound Powder of Cinnamon; 50 Gm. Hard Soap, all in powder; Syrup of Glucose, a sufficient quantity	Mix and form into a mass. Dose, four to eight grains (0.25 to 0.5 Gm.)
Galbani Composita Br. 1898	50 Gm. Asafetida; 50 Gm. Galbanum; 50 Gm. Myrrh; 25 Gm. Syrup of Glucose	Heat all together on a water-bath, stirring until the mass is uniform in consistence
Ipecacuanhæ cum Scillæ. Br.	30 Gm. Compound Powder of Ipecacuanha; 10 Gm. Squill; 10 Gm. Ammoniacum; Syrup of Glucose, a sufficient quantity	Mix and form a mass. Dose, four to eight grains (0.25 to 0.5 Gm.)
Ipecacuanhæ cum Urginea. Br.	30 Gm. Compound Powder of Ipecac; 10 Gm. Urginea; 10 Gm. Ammoniacum, Syrup of Glucose, a sufficient quantity	Mix and form a mass. Dose, 4 to 8 grains (0.25 to 0.50 Gm.)
Opii. U. S. P. VIII	6.5 Gm. powdered Opium; 2 Gm. powdered Soap and Water, a sufficient quantity	Mix. Make a mass and divide into 100 pills
Pilulæ Podophylli, Belladonnæ et Capsici U. S. P. VIII	1.6 Gm. of Resin of Podophyllum; 0.8 Gm. of Extract of Belladonna Leaves; 3.2 Gm. of Capsicum; 6.5 Gm. of Sugar of Milk; 1.6 Gm. Acacia; Water and Glycerin equal parts	Mix and form a mass by the aid of the Water and Glycerin and divide into 100 pills

Unofficial Pills—*Continued*

Name	Ingredients	Preparation
Pilula Quininæ Sulphatis. Br.	82 Gm. Quinine Sulphate; 3 Gm. Tartaric Acid; 12 Gm. Glycerin; 3 Gm. Tragacanth	Triturate the Quinine Sulphate with the Tartaric Acid, and form a mass with the mixed Glycerin and Tragacanth. Dose, two to eight grains (0.125 to 0.5 Gm.)
Saponis Composita. Br.	20 Gm. Opium, in powder; 60 Gm. Hard Soap; 20 Gm. Syrup of Glucose	Mix and form a mass. Dose, two to four grains (0.125 to 0.25 Gm.)
Scammonii Composita Br. 1898	25 Gm. Scammony Resin; 25 Gm. Jalap Resin; 25 Gm. Curd Soap; 75 mils Tincture of Ginger	Add the Tincture of Ginger to the Soap and Resins, form a solution with the aid of a gentle heat, and continue evaporation until it has acquired a pilular consistence
Scillæ Composita. Br.	25 Gm. Squill; 20 Gm. each of Ginger and Ammoniacum; 15 Gm. Hard Soap, all in powder, and 20 Gm. Syrup of Glucose	Mix and form a mass. Dose, four to eight grains (0.25 to 0.5 Gm.)
Urgineæ Composita. Br.	25 Gm. Urginea; 20 Gm. Ginger; 20 Gm. Ammoniacum; 15 Gm. Hard Soap; 20 Gm. Syrup of Glucose	Mix to form a mass. Dose, four to eight grains (0.25 to 0.50 Gm.)

Official Pills.—The following formulas for pills have been adopted by the U. S. P. IX with the view of securing uniformity in their preparation:

PILULÆ ALOES. U. S. Pills of Aloes

[Pil. Aloes]

	Metric	Old form
***Aloes,** in fine powder*	13 Gm.	201 gr.
Soap, in fine powder	13 Gm.	201 gr.
Water, a sufficient quantity,		
To make one hundred pills	100	100

Mix the powders intimately, then incorporate sufficient water to form a mass, and divide it into 100 pills.

Average Dose.—Two pills.

PILULÆ ASAFŒTIDÆ. U. S. Pills of Asafetida

[Pil. Asafœt.]

	Metric	Old form
***Asafetida**	20 Gm.	309 gr.
Soap, in fine powder	6 Gm.	93 gr.
Water, a sufficient quantity,		
To make one hundred pills	100	100

Beat the solids together with water, so as to form a mass, and divide it into 100 pills.

Average Dose.—Two pills.

PILULÆ CATHARTICÆ COMPOSITÆ. U. S. Compound Cathartic Pills
[Pil. Cathart. Co.]

	Metric	Old form
***Compound Extract of Colocynth**	80 Gm.	2 oz. av. 360 gr.
Mild Mercurous Chloride	60 Gm.	2 oz. av. 51 gr.
Resin of Jalap, in fine powder	20 Gm.	309 gr.
Gamboge, in fine powder	15 Gm.	231 gr.
Diluted Alcohol, a sufficient quantity,		
To make one thousand pills	1000	1000

Mix the powders intimately, then incorporate a sufficient quantity of diluted alcohol to form a mass, and divide it into 1000 pills.

Average Dose.—Two pills.

PILULÆ FERRI CARBONATIS. U. S. Pills of Ferrous Carbonate
[Pil. Ferr. Carb.—CHALYBEATE PILLS BLAUD'S PILLS FERRUGINOUS PILLS]

Each Pill contains not less than 0.06 Gm. of $FeCO_3$.

	Metric	Old form
***Granulated Ferrous Sulphate**	16 Gm.	247 gr.
Potassium Carbonate	8 Gm.	124 gr.
Sugar	4 Gm.	62 gr.
Tragacanth, in fine powder	1 Gm.	15 gr.
Althæa, in fine powder	1 Gm.	15 gr.
Glycerin, **Water, each, a sufficient quantity,**		
To make one hundred pills	100	100

Rub the potassium carbonate, in a mortar, with a sufficient quantity (about *five drops* each) of glycerin and water, then add the ferrous sulphate and sugar, previously triturated together to a uniform, fine powder, and rub the mass thoroughly, until it assumes a greenish color. When the reaction is complete, incorporate the tragacanth and althæa, and, if necessary, add a little more water, so as to obtain a mass of pilular consistence. Divide this into 100 pills.

NOTE.—In this process the 8 Gm. [old form 124 grains] of potassium carbonate may be replaced by 7.2 Gm. [old form 111 grains] of monohydrated sodium carbonate.

Assay.—Dissolve three Pills in 15 mils of diluted sulphuric acid and dilute the solution with distilled water to about 100 mils. The immediate titration with tenth-normal potassium dichromate V.S., potassium ferricyanide T.S. being used as indicator, shows not less than 0.06 Gm. of $FeCO_3$ in each pill.

Each mil of tenth-normal potassium dichromate V.S. used corresponds to 0.011584 Gm. of $FeCO_3$. Each Pill of Ferrous Carbonate corresponds to 5.2 mils of tenth-normal potassium dichromate V.S.

Average Dose.—Two pills.

PILULÆ FERRI IODIDI. U. S. Pills of Ferrous Iodide
[Pil. Ferr. Iod.]

	Metric	Old form
***Reduced Iron**	4 Gm.	62 gr.
Iodine	5 Gm.	77 gr.
Glycyrrhiza, in fine powder	4 Gm.	62 gr.
Sugar, in fine powder	4 Gm.	62 gr.
Extract of Glycyrrhiza, in fine powder	1 Gm.	15 gr.
Acacia, in fine powder	1 Gm.	15 gr.
Water, **Balsam of Tolu,** **Ether, each, a sufficient quantity,**		
To make one hundred pills	100	100

Add *six mils* [old form 97 minims] of water to the reduced iron, contained in a small mortar, and then, gradually, add the iodine, stirring constantly until the liquid ceases to have a reddish tint. Then add the remaining powders, previously well triturated together, and mix the whole thoroughly. Transfer the mass to a porcelain dish, evaporate the excess of moisture on a water bath, with constant stirring, and when the mass has acquired a pilular consistence divide it into 100 pills.

Dissolve 10 Gm. [old form 154 grains] of balsam of tolu in 15 mils [old form 243 minims] of ether, shake the pills with a sufficient quantity of this solution until they are uniformly coated, and put them on a plate to dry, occasionally rolling them about until the drying is completed.

Keep the pills in a well-stoppered bottle.

Tests for Impurities.—Pills of Ferrous Iodide are free from the odor of iodine.

Triturate a few of the pills with water, and filter the liquid; the filtrate does not assume more than a light blue tint upon the addition of starch T.S. (absence of more than traces of *free iodine*).

Average Dose.—Two pills.

PILULÆ PHOSPHORI. U. S. Pills of Phosphorus
[Pil. Phosphor.]

	Metric	Old form
***Phosphorus**	0.06 Gm.	1 gr.
Althæa, in No. 60 Powder	6.00 Gm.	93 gr.
Acacia, in fine powder	3.00 Gm.	46 gr.
Chloroform,		
Glycerin,		
Water,		
Balsam of Tolu,		
Ether, each, a sufficient quantity,		
To make one hundred pills	100	100

Dissolve the phosphorus, in a test tube, in 5 mils [old form 81 minims] of chloroform, with the aid of a very gentle heat, replacing from time to time any of the chloroform which may be lost by evaporation. Mix the althæa and acacia in a mortar, next add the solution of phosphorus, then immediately afterwards a sufficient quantity (about 4 mils [old form 65 minims]) of a mixture of 2 volumes of glycerin and 1 volume of water, and quickly form a mass; divide it into 100 pills.

Dissolve 10 Gm. [old form 154 grains] of balsam of tolu in 15 mils [old form 243 minims] of ether, shake the pills with a sufficient quantity of this solution until they are uniformly coated, and put them on a plate to dry, occasionally rolling them about until the drying is completed.

Keep the pills in a well-stoppered bottle.

Average Dose.—One pill.

PILULÆ RHEI COMPOSITÆ. U. S. Compound Pills of Rhubarb
[Pil. Rhei Co.]

	Metric	Old form
***Rhubarb,** in No. 80 powder	13.0 Gm.	201 gr.
Aloes, in fine powder	10.0 Gm.	154 gr.
Myrrh, in fine powder	6.0 Gm.	93 gr.
Oil of Peppermint	0.5 mil	8 min
Water, a sufficient quantity,		
To make one hundred pills	100	100

Mix the oil of peppermint intimately with the powders, then incorporate sufficient water to form a mass; divide it into 100 pills.

Average Dose.—Two pills.

PILULÆ AD PRANDIUM. N. F. Dinner Pills
[Pil. Ad Prand.]

1. When "Dinner Pills," under this or some other equivalent name, are prescribed without further specification, it is recommended that the *Pilulæ Aloes et Mastiches,* also called Lady Webster's Dinner Pills, be dispensed. Other similar pills are:

2. Chapman's Dinner Pills.

	Metric	Old form
Aloes, in fine powder	9.7 Gm.	150 gr.
Mastic, in fine powder	9.7 Gm.	150 gr.
Ipecac, in fine powder	6.5 Gm.	100 gr.
Oil of Fennel	1.5 mils	24 min.
Diluted Alcohol, a sufficient quantity,		
To make one hundred pills	100	100

Mix the ingredients intimately, form a mass and divide it into 100 pills.

Average Dose.—One pill.

3. Cole's Dinner Pills.

	Metric	Old form
Aloes, in fine powder	7.80 Gm.	120 gr.
Mass of Mercury	7.80 Gm.	120 gr.
Jalap, in fine powder	7.80 Gm.	120 gr.
Antimony and Potassium Tartrate	0.13 Gm.	2 gr.
Syrup, a sufficient quantity,		
To make one hundred pills	100	100

Mix the ingredients intimately, form a mass and divide it into 100 pills.

Average Dose.—One pill.

4. Hall's Dinner Pills.

	Metric	Old form
Aloes, in fine powder	6.5 Gm.	100 gr.
Extract of Glycyrrhiza	6.5 Gm.	100 gr.
Soap, in fine powder	6.5 Gm.	100 gr.
Syrup, a sufficient quantity,		
To make one hundred pills	100	100

Mix the ingredients intimately, form a mass and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ ALOES ET ASAFŒTIDÆ. N. F. Pills of Aloes and Asafetida
[Pil. Aloe. et Asafœt.]

	Metric	Old form
Aloes, in fine powder	9 Gm.	139 gr.
Asafetida	9 Gm.	139 gr.
Soap	9 Gm.	139 gr.
Water, a sufficient quantity,		
To make one hundred pills	100	100

Mix the ingredients intimately, form a mass and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ ALOES ET FERRI. N. F. Pills of Aloes and Iron

(U. S. P. VIII)

[Pil. Aloe. et Ferr.]

	Metric	Old form
Aloes, in fine powder	7 Gm.	108 gr.
Exsiccated Ferrous Sulphate	7 Gm.	108 gr.
Aromatic Powder	7 Gm.	108 gr.
Confection of Rose, a sufficient quantity,		
To make one hundred pills	100	100

Mix the powders intimately, then incorporate sufficient confection of rose to form a mass, and divide it into 100 pills.

Average Dose.—Two pills.

PILULÆ ALOES ET MASTICHES. N. F. Pills of Aloes and Mastic

(U. S. P. VIII)

[Pil. Aloe. et Mastich.—LADY WEBSTER'S DINNER PILLS]

	Metric	Old form
Aloes, in fine powder	13 Gm.	201 gr.
Mastic, in fine powder	4 Gm.	62 gr.
Red Rose, in fine powder	3 Gm.	46 gr.
Diluted Alcohol, a sufficient quantity,		
To make one hundred pills	100	100

Mix the powders intimately, then incorporate sufficient diluted alcohol to form a mass, and divide it into 100 pills.

Average Dose.—Two pills.

PILULÆ ALOES ET MYRRHÆ. N. F. Pills of Aloes and Myrrh

(U. S. P. VIII)

[Pil. Aloe. et Myrrh.]

	Metric	Old form
Aloes, in fine powder	13 Gm.	201 gr.
Myrrh, in fine powder	6 Gm.	93 gr.
Aromatic Powder	4 Gm.	62 gr.
Syrup, a sufficient quantity,		
To make one hundred pills	100	100

Mix the powders intimately, then incorporate sufficient syrup to form a mass, and divide it into 100 pills.

Average Dose.—Two pills.

PILULÆ ALOES ET PODOPHYLLI COMPOSITÆ. N. F. Compound Pills of Aloes and Podophyllum

[Pil. Aloe. et Podoph. Co.—JANEWAY'S PILLS]

	Metric	Old form
Aloes	6.50 Gm.	100 gr.
Resin of Podophyllum	3.25 Gm.	50 gr.
Pilular Extract of Belladonna Leaves	1.60 Gm.	24½ gr.
Extract of Nux Vomica	1.60 Gm.	24½ gr.
To make one hundred pills	100	100

Uniformly mix the several ingredients, form a mass and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ ALOES, HYDRARGYRI ET PODOPHYLLI. N. F. Pills of Aloes, Mercury, and Podophyllum

[**Pil. Aloe. Hydrarg. et Podoph.**—Pilulæ Triplices, N. F. III Triplex Pills Pilula Triplex]

	Metric	Old form
Aloes	13.0 Gm.	201 gr.
Mass of Mercury	6.5 Gm.	100 gr.
Resin of Podophyllum	1.6 Gm.	24½ gr.
To make one hundred pills	100	100

Uniformly mix the several ingredients, form a mass and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ ALOES, HYDRARGYRI ET SCAMMONII COMPOSITÆ. N. F. Compound Pills of Aloes, Mercury, and Scammony

[**Pil. Aloe. Hydrarg. et Scammon.**—Francis' "Triplex" Pills]

	Metric	Old form
Aloes	5.50 Gm.	85 gr.
Resin of Scammony	5.50 Gm.	85 gr.
Mass of Mercury	5.50 Gm.	85 gr.
Croton Oil	0.32 mil	5 min.
Oil of Caraway	1.60 mils	26 min.
Tincture of Aloes and Myrrh, a sufficient quantity,		
To make one hundred pills	100	100

Uniformly incorporate the oils with the other ingredients, add enough of the tincture to form a mass, and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ ALOINI COMPOSITÆ. N. F. Compound Pills of Aloin

[**Pil. Aloin. Co.**]

	Metric	Old form
Aloin	3.25 Gm.	50 gr.
Resin of Podophyllum	0.80 Gm.	12 gr.
Pilular Extract of Belladonna Leaves	1.60 Gm.	24½ gr.
To make one hundred pills	100	100

Uniformly mix the several ingredients, form a mass and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ ALOINI, STRYCHNINÆ ET BELLADONNÆ. N. F. Pills of Aloin, Strychnine and Belladonna

[**Pil. A. S. et B.**]

	Metric	Old form
Aloin	1.30 Gm.	20 gr.
Strychnine	0.05 Gm.	¾ gr.
Pilular Extract of Belladonna Leaves	0.80 Gm.	12 gr.
To make one hundred pills	100	100

Uniformly mix the several ingredients, form a mass and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ ALOINI, STRYCHNINÆ ET BELLADONNÆ COMPOSITÆ.

N. F. Compound Pills of Aloin, Strychnine and Belladonna

[Pil. A. S. et B. Co.]

	Metric	Old form
Aloin	1.30 Gm.	20 gr.
Strychnine	0.05 Gm.	¾ gr.
Pilular Extract of Belladonna Leaves	0.80 Gm.	12 gr.
Extract of Cascara Sagrada	3.25 Gm.	50 gr.
To make one hundred pills	100	100

Uniformly mix the several ingredients, form a mass and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ ANTIDYSPEPTICÆ. N. F. Antidyspeptic Pills

[Pil. Antidyspep.]

	Metric	Old form
Strychnine	0.16 Gm.	2½ gr.
Ipecac, in fine powder	0.65 Gm.	10 gr.
Pilular Extract of Belladonna Leaves	0.65 Gm.	10 gr.
Mass of Mercury	13.00 Gm.	201 gr.
Compound Extract of Colocynth	13.00 Gm.	201 gr.
To make one hundred pills	100	100

Uniformly mix the strychnine, ipecac, and extract of belladonna leaves, then incorporate the other ingredients, form a mass and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ ANTIMONII COMPOSITÆ. N. F. Compound Pills of Antimony

[Pil. Antimon. Co.—PLUMMER'S PILLS]

	Metric	Old form
Sulphurated Antimony	4 Gm.	62 gr.
Mild Mercurous Chloride	4 Gm.	62 gr.
Guaiac, in fine powder	8 Gm.	123½ gr.
Castor Oil, a sufficient quantity,		
To make one hundred pills	100	100

Uniformly mix the solid ingredients, form a mass with sufficient castor oil, and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ ANTIPERIODICÆ. N. F. Antiperiodic Pills

[Pil. Antiperiod.—WARBURG'S PILLS]

	Metric	Old form
Extract of Aloes, in fine powder	6.5 Gm.	100 gr.
Rhubarb, in fine powder	3.2 Gm.	49 gr.
Angelica Fruit, in fine powder	3.2 Gm.	49 gr.
Inula, in fine powder	1.6 Gm.	24½ gr.
Saffron, in fine powder	1.6 Gm.	24½ gr.
Fennel, in fine powder	1.6 Gm.	24½ gr.
Zedoary, in fine powder	0.8 Gm.	12¼ gr.
Cubeb, in fine powder	0.8 Gm.	12¼ gr.
Myrrh, in fine powder	0.8 Gm.	12¼ gr.
Agaric, in fine powder	0.8 Gm.	12¼ gr.
Camphor, in fine powder,	0.8 Gm.	12¼ gr.
Quinine Sulphate	9.0 Gm.	139 gr.
Extract of Gentian, a sufficient quantity,		
To make one hundred pills	100	100

Mix the powders and quinine sulphate uniformly, make into a mass with the extract of gentian, and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ ANTIPERIODICÆ SINE ALOE. N. F. Antiperiodic Pills without Aloes

[**Pil. Antiperiod. s. Aloe**—Warburg's Pills Without Aloes]

Prepare the Pills as directed under *Pilulæ Antiperiodicæ,* omitting the Extract of Aloes.

Average Dose.—One pill.

PILULÆ CATHARTICÆ VEGETABILES. N. F. Vegetable Cathartic Pills

(U. S. P. VIII)

[**Pil. Cathart. Veget.**]

	Metric	Old form
Compound Extract of Colocynth	6.0 Gm.	93 gr.
Extract of Hyoscyamus	3.0 Gm.	46 gr.
Resin of Jalap, in fine powder	2.0 Gm.	31 gr.
Extract of Leptandra	1.5 Gm.	23 gr.
Resin of Podophyllum	1.5 Gm.	23 gr.
Oil of Peppermint	0.8 mil	13 min
Diluted Alcohol, a sufficient quantity,		
To make one hundred pills	100	100

Mix the compound extract of colocynth intimately with the resin of podophyllum, resin of jalap, and extract of leptandra, and then add the oil of peppermint and the extract of hyoscyamus, form a mass with sufficient diluted alcohol and divide it into 100 pills.

Average Dose.—Two pills.

PILULÆ COLOCYNTHIDIS COMPOSITÆ. N. F. Compound Pills of Colocynth

[**Pil. Colocynth. Co.**—Pilulæ Cocciæ Cochia Pills]

	Metric	Old form
Extract of Colocynth	1.1 Gm.	17 gr.
Aloes	13.0 Gm.	201 gr.
Resin of Scammony	13.0 Gm.	201 gr.
Oil of Clove	1.5 mils	24 min.
Diluted Alcohol, a sufficient quantity,		
To make one hundred pills	100	100

Uniformly mix the solid ingredients, incorporate the oil, form a mass and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ COLOCYNTHIDIS ET HYOSCYAMI. N. F. Pills of Colocynth and Hyoscyamus

[**Pil. Colocynth. et Hyoscy.**]

	Metric	Old form
Extract of Colocynth	0.65 Gm.	10 gr.
Aloes	9.70 Gm.	150 gr.
Resin of Scammony	9.70 Gm.	150 gr.
Extract of Hyoscyamus	9.70 Gm.	150 gr.
Oil of Clove	1.00 mil	16 min.
To make one hundred pills	100	100

Uniformly mix the solid ingredients, incorporate the oil, form a mass and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ COLOCYNTHIDIS ET PODOPHYLLI. N. F. Pills of Colocynth and Podophyllum

[**Pil. Colocynth. et Podoph.**]

	Metric	Old form
Compound Extract of Colocynth	16.2 Gm.	250 gr.
Resin of Podophyllum	1.6 Gm.	24½ gr.
Syrup, a sufficient quantity,		
To make one hundred pills	**100**	**100**

Uniformly mix the ingredients, form a mass and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ DIGITALIS, SCILLÆ ET HYDRARGYRI. N. F. Pills of Digitalis, Squill, and Mercury

[Pil. Digit. Scill. et Hydrarg.—NIEMEYER PILLS FOR DROPSY GUY'S PILLS]

	Metric	Old form
Digitalis, in fine powder	6.5 Gm.	100 gr.
Squill, in fine powder	6.5 Gm.	100 gr.
Mass of Mercury	6.5 Gm.	100 gr.
Clarified Honey, a sufficient quantity,		
To make one hundred pills	100	100

Uniformly mix the solid ingredients, form a mass with the aid of the honey, and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ FERRI, QUININÆ, ALOES ET NUCIS VOMICÆ. N. F. Pills of Iron, Quinine, Aloes, and Nux Vomica

[Pil. Ferr. Quin. Aloe. et Nuc. Vom.—PILULÆ QUADRUPLICES, N. F. III. QUADRUPLEX PILLS PILULÆ FERRI ET QUININÆ COMPOSITÆ]

	Metric	Old form
Exsiccated Ferrous Sulphate	6.5 Gm.	100 gr.
Quinine Sulphate	6.5 Gm.	100 gr.
Aloes	6.5 Gm.	100 gr.
Extract of Nux Vomica	1.6 Gm.	24½ gr.
Extract of Gentian, a sufficient quantity,		
To make one hundred pills	100	100

Mix the extract of nux vomica with the aloes, thoroughly incorporate the ferrous sulphate and quinine sulphate, then form a mass with the extract of gentian and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ FERRI, QUININÆ, STRYCHNINÆ ET ARSENI FORTIORES. N. F. Stronger Pills of Iron, Quinine, Strychnine, and Arsenic

[Pil. Ferr. Quin. Strych. et Arsen. Fort.—PILULÆ METALLORUM, N. F. III. METALLIC PILLS PILULÆ METALLORUM AMARÆ BITTER METALLIC PILLS]

	Metric	Old form
Reduced Iron	6.50 Gm.	100 gr.
Quinine Sulphate	6.50 Gm.	100 gr.
Strychnine	0.32 Gm.	$4\frac{9}{10}$ gr.
Arsenic Trioxide	0.32 Gm.	$4\frac{9}{10}$ gr.
Clarified Honey, a sufficient quantity,		
To make one hundred pills	100	100

Mix the ingredients intimately, form a mass, and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ FERRI, QUININÆ, STRYCHNINÆ ET ARSENI MITES. N. F. Mild Pills of Iron, Quinine, Strychnine, and Arsenic

[Pil. Ferr. Quin. Strych. et Arsen. Mit.—AITKEN TONIC PILLS]

	Metric	Old Form
Reduced Iron	4.50 Gm.	69½ gr.
Quinine Sulphate	6.50 Gm.	100 gr.
Strychnine	0.13 Gm.	2 gr.
Arsenic Trioxide	0.13 Gm.	2 gr.
Clarified Honey, a sufficient quantity,		
To make one hundred pills	100	100

Mix the ingredients intimately, form a mass, and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ GLYCERYLIS NITRATIS. N. F. Pills of Nitroglycerin

[**Pil. Glycer. Nit.**—Pilulæ Glonoini, N. F. III Pills of Glonoin]

	Metric	Old form
Spirit of Glyceryl Trinitrate	6.5 Gm.	100 gr.
Althæa, in fine powder	6.5 Gm.	100 gr.
Confection of Rose, a sufficient quantity,		
To make one hundred pills	100	100

Mix the spirit of nitroglycerin intimately with the powdered althæa, expose the mixture for a short time to the air that the alcohol may evaporate, avoiding heat, then make a mass with the aid of confection of rose, and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ LAXATIVÆ COMPOSITÆ. N. F. Compound Laxative Pills

(U. S. P. VIII)

[**Pil. Lax. Co.**]

	Metric	Old form
Aloin	1.30 Gm.	20 gr.
Strychnine	0.05 Gm.	¾ gr.
Pilular Extract of Belladonna Leaves	0.80 Gm.	12¼ gr.
Ipecac, in fine powder	0.40 Gm.	6 gr.
Glycyrrhiza, in fine powder	4.60 Gm.	71 gr.
Syrup, a sufficient quantity,		
To make one hundred pills	100	100

Triturate the aloin, strychnine, ipecac, and glycyrrhiza together thoroughly, so as to produce a uniform powder. Incorporate with this the extract of belladonna leaves and sufficient syrup to form a mass, and divide it into 100 pills.

Average Dose.—Two pills.

PILULÆ LAXATIVÆ POST PARTUM. N. F. Post Partum Laxative Pills

[**Pil. Lax. Post Part.**—Barker's Post Partum Pills]

	Metric	Old form
Compound Extract of Colocynth	11.0 Gm.	170 gr.
Aloes	5.5 Gm.	85 gr.
Extract of Nux Vomica	2.5 Gm.	38½ gr.
Resin of Podophyllum	0.5 Gm.	7½ gr.
Ipecac, in fine powder	0.5 Gm.	7½ gr.
Extract of Hyoscyamus	8.0 Gm.	123½ gr.
Diluted Alcohol, a sufficient quantity,		
To make one hundred pills	100	100

Mix the ingredients intimately, form a mass and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ OPII, DIGITALIS ET QUININÆ. N. F. Pills of Opium, Digitalis, and Quinine

[**Pil. Opii Digit. et Quin.**—Niemeyer Pills for Phthisis]

	Metric	Old form
Powdered Opium	1.0 Gm.	15 gr.
Digitalis, in fine powder	6.5 Gm.	100 gr.
Quinine Sulphate	6.5 Gm.	100 gr.
Clarified Honey, a sufficient quantity,		
To make one hundred pills	100	100

Mix the ingredients intimately, form a mass and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ OPII ET CAMPHORÆ. N. F. Pills of Opium and Camphor

[Pil. Opii et Camph.]

	Metric	Old form
Powdered Opium	**6.5 Gm.**	100 gr.
Camphor	**13.0 Gm.**	201 gr.
Clarified Honey, a sufficient quantity,		
To make one hundred pills	**100**	100

Mix the ingredients intimately, form a mass and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ OPII ET PLUMBI. N. F. Pills of Opium and Lead

[Pil. Opii et Plumb.]

	Metric	Old form
Powdered Opium	**6.5 Gm.**	100 gr.
Lead Acetate	**6.5 Gm.**	100 gr.
Clarified Honey, a sufficient quantity,		
To make one hundred pills	**100**	100

Mix the ingredients intimately, form a mass and divide it into 100 pills.

Average Dose.—One pill.

PILULÆ RHEI. N. F. Pills of Rhubarb

[Pil. Rhei]

	Metric	Old form
Rhubarb, in fine powder	**20 Gm.**	309 gr.
Soap, in fine powder	**6 Gm.**	93 gr.
Water, a sufficient quantity,		
To make one hundred pills	**100**	100

Form a mass and divide it into 100 pills.

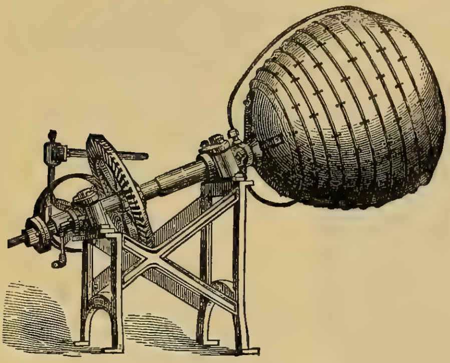
Average Dose.—One pill.

COATING PILLS

Pills are coated with sugar, chocolate, gelatin, silver leaf, gold leaf, salol, and talcum or French chalk, etc., with the view of masking their taste or rendering them enteric.

Sugar Coating.—The sugar coating of pills is carried on upon a very large scale in this country. The pills are carefully dried, placed in a round-bottomed copper pan, a mixture of syrup and starch added, the whole heated, and the pan kept moving constantly, so that a rotary motion is imparted. While evaporation takes place, additions of syrup are made from time to time, so that a crust of sugar gradually forms upon the surface of each pill. Fig. 714 shows the usual form of pill coater. The rotary motion and heating of the copper pan are effected by the use of steam. In Fig. 715 is shown a small "table coating pan," made by the F. J. Stokes Machine Company, to be employed without the use of steam coils. It is intended to be bolted on a table or bench, and is not adapted to the coating of a large number of pills. A polish is given to the pills by agitating them in a bag or rolling them in a shaker in contact with a piece of wax or paraffin, or by using a machine like that shown in Fig. 716. It is made by the F. J. Stokes Machine Company, of Philadelphia. The inside of the circular holder is lined with canvas which holds the paraffin, and it is rotated by steam power.

FIG. 714



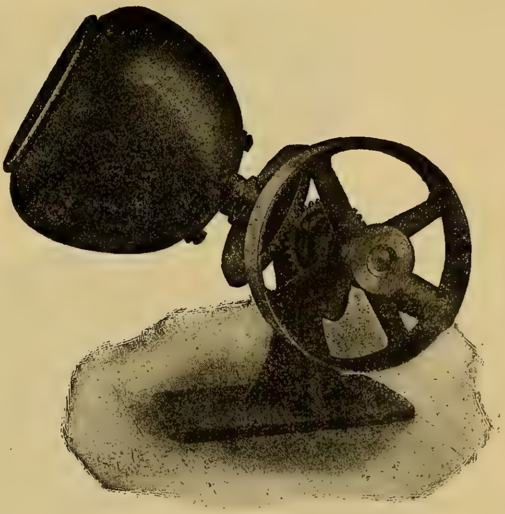
Machine for sugar coating pills

Chocolate coated pills are made like sugar coated pills, chocolate being added to the pan to flavor and color the coating. It is suspected, however, that some manufacturers replace the real substance with sufficient "burnt umber" or similar coloring to match the color of the chocolate.

Pills cannot be satisfactorily coated with sugar in the small way without much labor. This is not the case with gelatin coating. It is quite possible for the pharmacist to coat pills with gelatin and be able to dispense them in fifteen minutes.

Gelatin Coating.—The coating of pills with gelatin is an old process. Formerly each pill was impaled upon a long needle, dipped into a solution of gelatin, and the end of the needle stuck into a cork to permit the coating to dry. This slow process was improved by Charles B. Allaire, who devised a machine for dipping a number of pills at once, and also one for stripping the needle bar. Since then many machines have been introduced for coating pills with gelatin, and since the introduction of sugar, gum, or saccharin in small quantities to the gelatin mass their use is likely to increase. Prof. Patch's coater is shown in Fig. 717. The dried pills, which must not be made with glycerin, roll down the inclined grooves, shown in the tray in the drawing, until each of the hemispherical depressions at

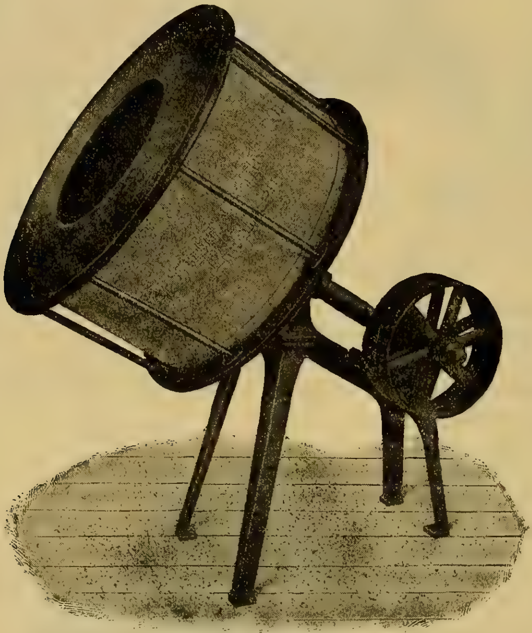
FIG. 715



Small table coating pan

the end of the groove contains a pill. A wooden strip armed with sixteen needles is inverted over the sixteen pills in the depressions, and the points of the needles are pressed into them until every one is impaled. The adjustable handle is now attached, and the pills are dipped into a hot aqueous solution of gelatin (page 1759), and then gently twirled until the coating has set, when the strip is transferred to the catch in the wheel. This wheel is made to rotate, first in one direction and then in the opposite, by alternately pulling and relaxing the string attached to the axle. This rapidly dries the coating. The needles are stripped of the pills by engaging them in the comb, which is shown in the cut. In the Franciscus pill coater the needles are set in a brass bar, and the rotation is in a different direction (see Fig. 718). Other machines are favorably known. In the larger sized Porcupine pill coater the revolution of the cylinder to which the needle bars are attached is effected by clock work.

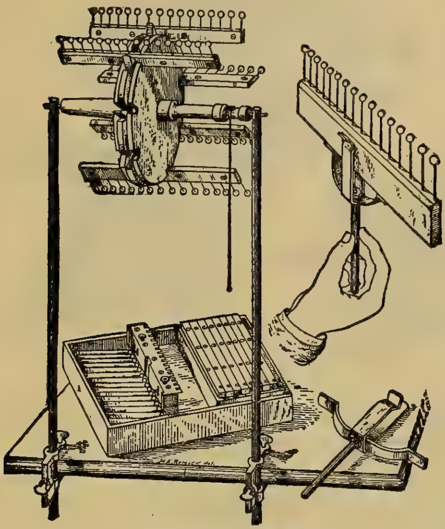
Fig. 716



Machine for polishing pills

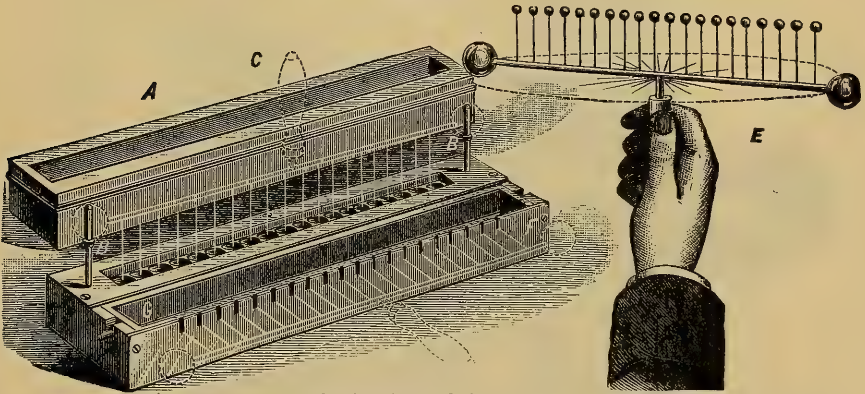
Maynard's pill coater is illustrated by Figs. 719, 720, 721, 722, 723, and 724. It is operated by first placing the flat metallic ring, F, around the feeding plate, E, and pouring the pills into the cup which is thus formed. The conical indentations in E are filled, and the excess of pills remaining on the top of the plate is permitted to roll off into a box. The dipper or needle holder, D, is then placed in position immediately over the pills on the feeding plate, the guide pins on the sides securing accuracy in centring the pills with the needle points. The handle of the needle holder is then pressed downward until the points of the needles enter the pills nearly to their centres. The pills, after they are impaled, as seen at C, are dipped into the melted gelatin solution. The needle holder is then slowly revolved in the air in order to facilitate the even distribution of the gelatin film on the surface of the pills. When the film becomes thoroughly cold, it should be solid enough to permit the pills to be stripped from the needles. It is well to have two needle holders, so that while the gelatin on the pills on one is solidifying the other may be started on the coating. In this way the process is rendered continuous. When the coating on the pills is sufficiently hard, the pills are stripped from the needles by grasping the circular plate on the needle holder with one hand and pulling the handle of the needle holder upward. The pills drop off, and should be deposited on the tray of wire gauze, B, to dry. The circular plate through which the needles pass should be slightly greased with cosmoline to prevent the pills from adhering to it. The gelatin solution is heated in an agate ironware dish, set in a copper water bath having a cover. This arrangement prevents a film from forming on the surface and aids in retaining the uniformity of the gelatin solution. When the pills are not being dipped, the cover should be kept on the dish.

Fig. 717



Prof. Patch's gelatin coater

Fig. 718

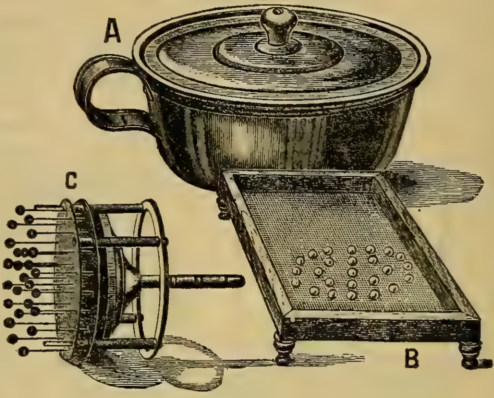


The Franciscus gelatin coater

A pill coater is shown in Fig. 725 which was devised by A. J.

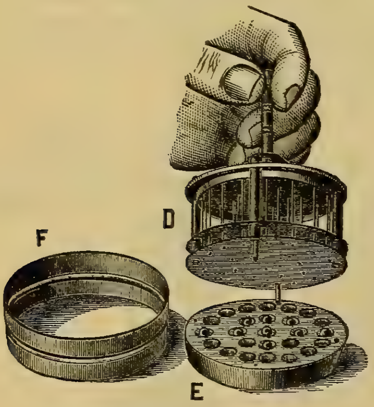
Palethorpe, of Bingham, Notts, England. It is similar to Maynard's pill coater, but it has some advantages over it. It is made very substantially; the shape of the needle plate is hexagonal instead of round, and this prevents it from rolling off the counter. It is used, according to the directions of Mr. Palethorpe, as follows:

Figs. 719, 720, 721



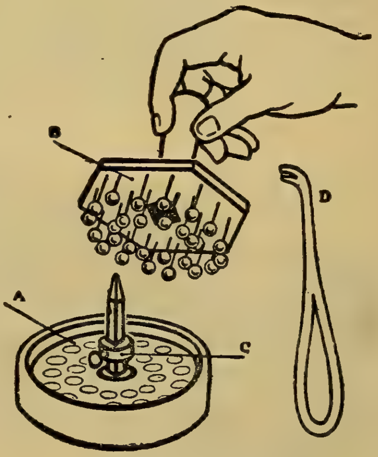
Maynard's pill coater

Figs. 722, 723, 724



Maynard's pill coater

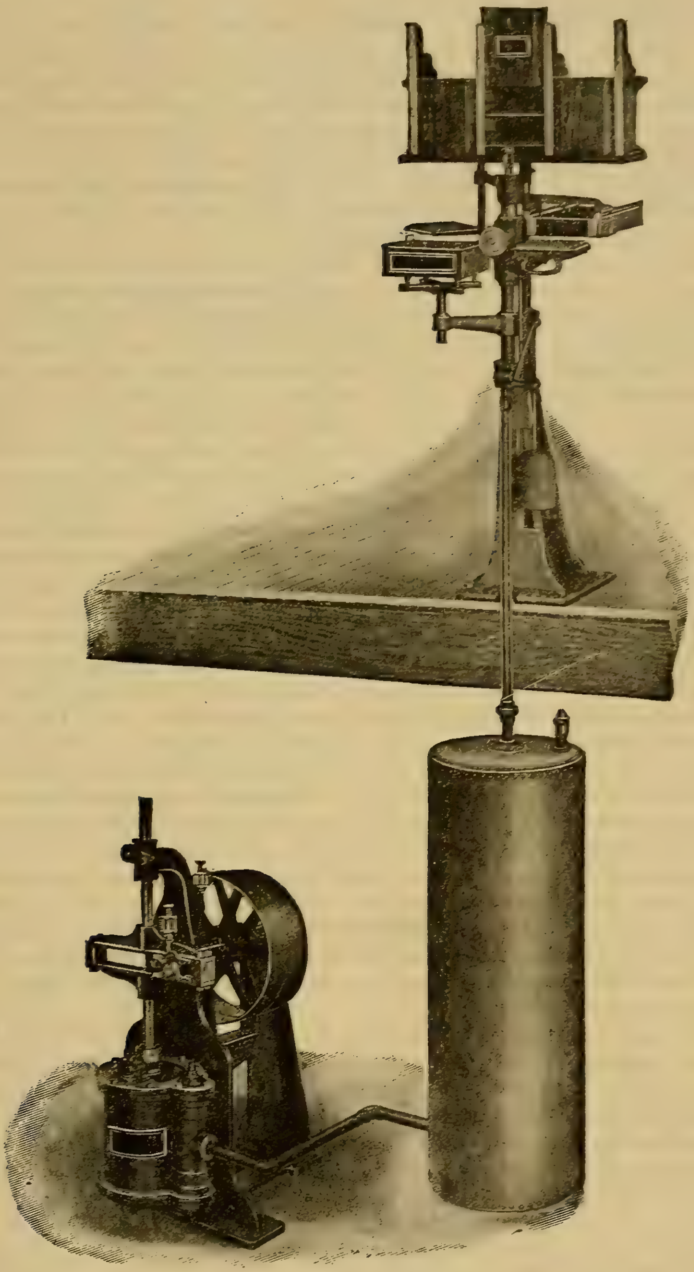
Fig. 725



Palethorpe's gelatin coater

"Place the pills, free from powder, in the tray, A, and give this a turn. The pills having 'found' the holes, take the needle plate, B, by the handle, and having regulated the sliding bar, C, so that the needles may be depressed the proper depth, pass the plate on to the guide through the square hole, and with a firm and even pressure, press the needles into the pills and remove the plate. Now dip the pills completely into the solution, and just before removal allow them to rest on the surface of the solution for a second to remove the excess. Reverse the plate, with the pills upward, turn in the hand until the solution ceases to run, and set aside for a short time to harden. This is best effected by raising the sliding bar and resting the plate thereon, the pills being all clear of the woodwork. When sufficiently dry, remove the plate and pluck off the pills with the hook D. The pills are thus not touched by the fingers at all. If it is important to get rid of the needle holes, carefully apply a 'spot' of gelatin solution, diluted to half strength with water, with a camel's

FIG. 726



Colton's gelatin coater

hair pencil, taking care not to leave an excess of gelatin over the holes, and allow to dry."

A valuable invention in coating pills with gelatin was made by J. B. Russell. Needles for impaling the pills before dipping have been discarded, and the pills are held firmly upon the ends of tubes by suction, the tubes being connected with a box from which the air has been exhausted by a vacuum pump. A little over one-half of each pill is dipped in the gelatin solution. This is rapidly dried. Subsequently the pill is reversed, and the uncoated portion is then dipped, thus completing the coating. The process is used in many of the large manufacturing laboratories.

The great demand for gelatin coated pills has stimulated the manufacturers to perfect machines for making them on a large scale. Fig. 726 shows one of these made by Arthur Colton, of Detroit. It is not the largest made by this firm, although this one has the capacity to coat 50,000 pills in ten hours. The vacuum pump and tank is seen in position on the floor below, but it may be located in any convenient place. After the pills are made and seasoned they are ready for coating. The pill drawer is first stored with pills, the front of which contains a feeding plate, registering with the dipping plate. The latter is now placed upon the vacuum jacket and clamped to place; the pill drawer is then pulled forward, which brings the feeder exactly in proximity with the dipping plate. The vacuum being on, the pills are carefully brushed upon the feeding plate, when every receptacle will be filled. The pills are held in place by the force of the suction supplied from the exhaust tank. The pill drawer is returned to its place, and the vacuum jacket (containing the dipping plate and pills) is now reversed for immersion. This done, the jacket is inverted to the first position and the vacuum shut off. The plate is released from its seat and then placed in the kiln to dry the pills, after which the operation is repeated, leaving but one plate (for the beginning of reverse operations). This is placed upon the vacuum jacket, precisely in the same manner as previously described. The plate is now taken from the drying kiln and placed securely upon the transferring apparatus; then, with the lever, the two are brought into close contact, one above the other. The force of the vacuum acting through the perforations will immediately release the pills, transferring them instantly to the dipping plate on the jacket. The operator then proceeds to immerse the uncoated half of pills in the manner first described.

Pills may be coated with gelatin by cutting the pill cylinder to its center, placing in the cleft a piece of sewing silk, rolling it, dividing it into pills, dipping in gelatin solution, drying, and cutting apart.

Pills are also coated with a gelatin mixture in revolving pans, by a process similar to that used for sugar coating, and this possesses the advantage of greater speed and marked reduction in machinery and labor cost as compared with the dipping process.

GELATIN COATING SOLUTION

(Prof. Patch)

Gelatin (French, gold label)	2½ oz. av.
Powdered Boric Acid	120 gr.
Mucilage of Acacia	2 fl. oz.
Distilled Water	7 fl. oz.

Macerate the gelatin with the water until it softens, dissolve it by heating on a water-bath, and add the boric acid; then slowly add the mucilage of acacia, and strain the mixture. If sweetening is desired, a very small quantity of soluble saccharin may be used.

The N. F. IV directions for salol coating are given below and, with a little practice, have been found to be satisfactory at the prescription counter. The most important point is to learn the exact time in the cooling of the salol, at which to add the pills. If it is too hot, the coating does not adhere to the pills, but cools on the side of the dish; and if too hot, when the second or third coating is being applied, it melts off the previous coating. On the other hand, if too cool and already crystallizing, it forms small nodules on the pill and an irregular coating results.

The rotating of the pan or dish containing the melted salol should be started before the pills are added and continued, without interruption, until the coating is hard, which, if the temperature is right, should require only a few seconds. The N. F. directions are as follows:

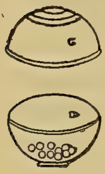
Salol Coating.—Drop the pills, carefully freed from dusting powder, into an enameled or porcelain dish, preferably with a flat bottom and straight sides, containing enough phenyl salicylate (approximately 0.06 Gm. [old form 10 grains] to every 0.12 Gm. pill), previously just melted by the heat of a water bath and allowed to cool so that on passing the hand along the bottom of the dish there is scarcely any warmth felt, yet the salt remains completely melted. Start the dish to rotating before adding the pills and continue rotation until the pills are coated and the phenyl salicylate has congealed. Repeat this process twice, each time reducing the amount of phenyl salicylate about one-half. Finally, apply a finishing coat by using only sufficient phenyl salicylate to barely coat the dish when melted, repeating the operation as before.

Keratin Coating.—Keratin is made from corneous animal substances, like horn, quills, hoofs, etc., by steeping these in an acid solution of pepsin or acetic acid, and dissolving the residue in ammonia water and evaporating the solution. The coating is applied like sugar coating, but is rarely used to-day.

Enteric Pills.—A number of substances have been employed for the purpose of coating pills, so as to enable them to pass through the acid juices of the stomach and be dissolved in the alkaline intestinal fluids; such pills are called *enteric pills*. It is proposed to use these coatings for four classes of medicine: 1. Medicines that can by prolonged contact cause irritation to the mucous membrane of the stomach—arsenic, salicylic acid, creosote, chrysarobin, quinine compounds, copaiba, cubebs, ferruginous preparations, and especially ferric chlorides, opium, mercurial preparations, mercuric iodide and chloride, phosphorus, and all the tænifuge preparations. 2. Medicines that can injure the digestion by forming insoluble precipitates with pepsin and peptones—tannin, alum, lead acetate, preparations of bismuth, silver nitrate, corrosive sublimate, etc. 3. Medicines that are rendered inactive or decomposed by the gastric juice—alkali, bile, soap, calcium sulphide, iron sulphide, pancreatin, etc. 4. Medicines which should arrive in the intestines as concentrated as possible—kousso, santonin, extract of male fern, and alkali. For this purpose several substances have been proposed, chiefly salol (phenyl salicylate), keratin and stearic acid. The employment of keratin has been discredited and its use largely discontinued, and stearic acid has not been thoroughly tested so that salol is chiefly depended upon for the making of enteric pills. (See also Enteric Capsules, page 1781.)

Pearl Coating.—This term is applied to the method of coating pills with finely powdered talcum or French chalk; the process is similar to that used in silver coating (see below), by placing in a globular box (see Fig. 727) a mixture of very finely powdered talcum and sugar, and, having covered the pills with the adhesive mixture, they are rotated until coated. A polish may be given to the surfaces by rotating the pills in a box coated on the inside with paraffin.

FIG. 727



Silver coater

Gold or Silver Coating.—Pills may be coated with gold or silver leaf by first placing a drop of syrup of acacia, or a small quantity of a thick mucilage of acacia, in a mortar, and, after carefully spreading it over the surface with the end of the finger, dropping in the pills, rotating them, with the aid of the finger if necessary, so that they shall be uniformly coated with a very thin layer of mucilage, and then dropping them into the gold or silver leaf contained in the coater. This is merely a smooth, globular box, made of horn or turned wood, opening in the middle (see Fig. 727). When the pills are rotated, they soon become coated with the leaf, and are then ready to dispense. In the absence of a globular box a large sized pill box may be used. This process is also described in the N. F. IV.

Other extemporaneous coatings suggested by the N. F. are as follows:

Sugar Coating.—Quickly roll the pills, freed from dusting powder, on a filter paper saturated with mucilage of acacia, until uniformly but superficially moist, then immediately transfer them to a porcelain dish containing a mixture of eight parts of powdered sugar or sugar of milk and two parts of powdered acacia, and rapidly rotate them until covered with a firm white coating.

Cocoa Coating.—Quickly roll the pills, freed from dusting powder, on a filter paper saturated with mucilage of acacia, until uniformly but superficially moist, shake them at once with powdered cocoa until well coated, then immediately transfer them to a clean, warmed porcelain dish, and rapidly rotate them until a smooth coating is produced.

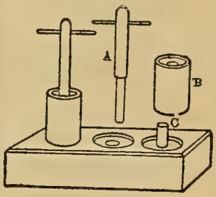
Tolu Coating.—Drop the pills, freed from dusting powder, into a porcelain dish in which a thin layer of equal volumes of tincture of tolu and ether has been previously placed, and rotate them until thoroughly coated with the mixture. Turn them at once into another dish of the same kind and size, and rotate for a few moments to remove the excess of mixture, and while the pills are still shining, but not too moist, transfer them to a third dish, previously coated with a very thin film of oil, which has been applied by the tips of the fingers, and rotate them until dry. A second or a third coating may be applied in the same manner, if necessary.

Stearic Acid Coating.—The use of stearic acid as an enteric coating for pills has been suggested by William G. Toplis. The coating is applied by adding a saturated, ethereal solution of stearic acid to the pills, in a dish, and at the same time rotating the pills. The solution is added carefully, only a few drops at a time, until the coating is complete.

COMPRESSED PILLS, TROCHES, AND TABLETS

Compressed pills, troches, and tablets are made by subjecting dry, granular powders to a sufficient degree of pressure in suitable machines to cause them to cohere; the pressure may be effected by a blow from a mallet, or by means of a lever or combination of levers. To enable the pharmacist to prepare small quantities of his own compressed tablets, the author devised, in 1875, the machine for making them shown in Fig. 728. It is made of cast steel. The base has two countersunk depressions, with a short post in the centre of each; a lenticular depression is made in the upper surface of each post. A steel cylinder having a central aperture of the diameter of the post is placed in the depression, the proper quantity of powder is introduced, and the plunger, which has a corresponding lenticular depression on its lower surface, is placed on the powder and is struck a quick blow with a mallet; the powder is compressed, and the pill adheres to the cylinder; by removing the cylinder and holding it over a box and tapping the plunger again lightly, the pill is forced out, and falls into a box. While the moulding of various forms of medication into tablets had been known for many years, William Brockedon, of England, was the first manufacturer to introduce this form of pill on a commercial scale. The records show that he was granted an English patent in 1843 for a machine to make pills and lozenges by pressure between dies. In this country, Jacob Dunton, of Philadelphia, was the first to extend the process to a long line of pills, but subsequently John Wyeth & Bro. prepared compressed pills upon an enormous scale, and they are made now by many manufacturers, both here and abroad.

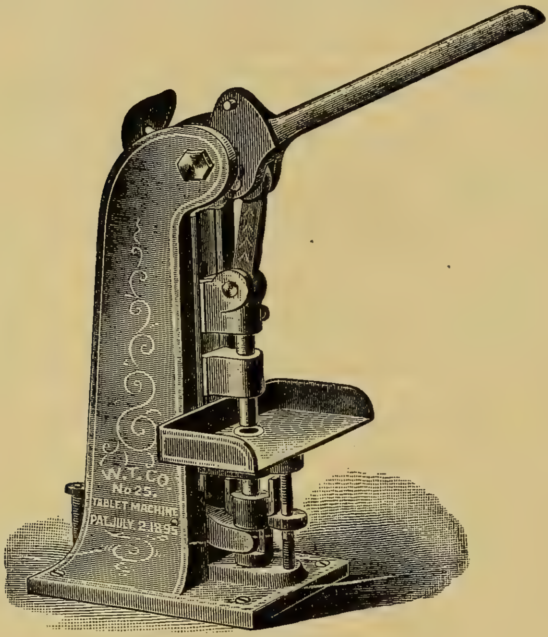
FIG. 728



Compressed pill machine

Machines for making compressed pills and troches which are adapted for either hand or steam power are now made so extensively that it is difficult to make a selection. Machines that are to be operated by hand are, of course, not so heavy in their construction. Fig. 729 shows a small hand tablet machine operated by pressure. It is made by Whitall Tatum Company, and is suitable for the preparation of a few tablets, extemporaneously, at the prescription counter. Fig. 730 shows the tablet machine made by the H. K. Mulford Company, of Philadelphia. Machines of this type are so constructed that a single punch may be used or multiple punches in the heavier machines may be inserted, and the capacity thus increased. Various forms of these multiple punches carry from two up to twelve or even more punches, the dies having a corresponding number of openings. The material which is to be compressed is fed into the funnel or hopper. In the lower part of this funnel there is a sieve, to prevent large lumps from passing through and clogging the feeder. By means of simple yet ingenious mechanism the powder finds its way to the die plate, the feeder being shaken constantly in order to keep the powder in motion, so that uniformity in feeding is secured while it is being delivered. When the chamber in the die plate has received its charge, the feeder moves out of the way to make room for the compressor, which then forms the tablet in the die. The ejector follows the compressor after it has moved out of the die plate, and the tablet is knocked off and into the pan underneath by the feeder. The same motions are repeated continuously. When everything is in order and the machine is properly operated, compressed tablets may be made very rapidly. The weight of the tablet may be adjusted with simplicity and accuracy.

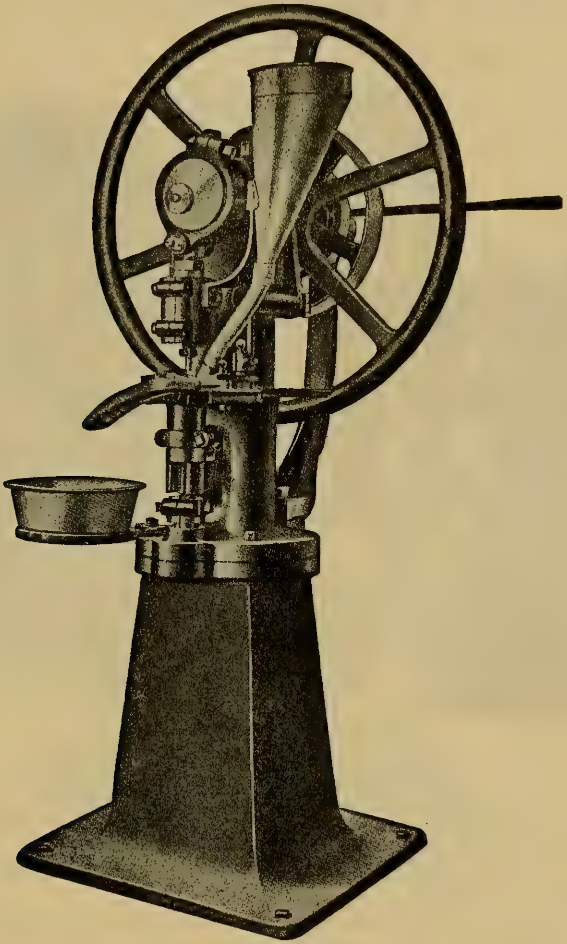
Fig. 729


W.T.CO.
No. 25.
TABLET MACHINE
PAT. JULY 2.1895

Hand tablet machine

Fig. 731 shows the Eureka tablet machine, made by the F. J. Stokes Machine Company, of Philadelphia. This machine is well adapted for the use of the pharmacist. It is entirely automatic, and will compress 100 tablets per minute. In Fig. 732 an enlarged view showing the method of compressing the tablet with this machine is seen. A is the upper punch or compressor just leaving the die, B. The tablet is shown in the die after it has been compressed. This will be raised by the lower punch, C, to the surface, where the feed cup will eject it and fill the die with another charge of material, upon which the operation will be repeated. D is the adjustment for regulating the lower punch, so that it ejects the tablet properly. E is the adjustment for regulating the weight of the tablet, and F is the adjustment for controlling the pressure or density of the tablet.

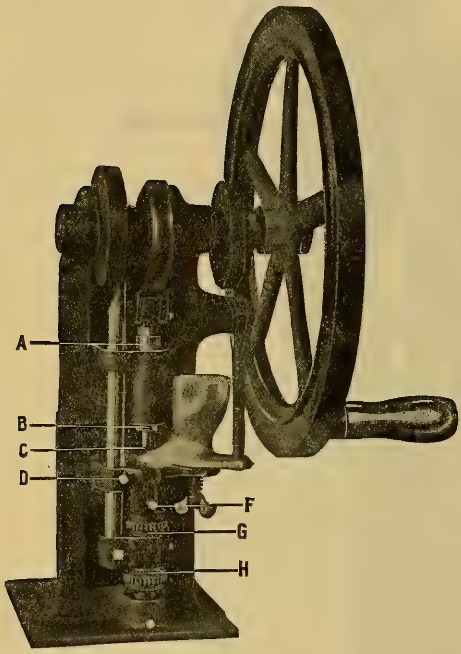
Fig. 730



Mulford's tablet machine.

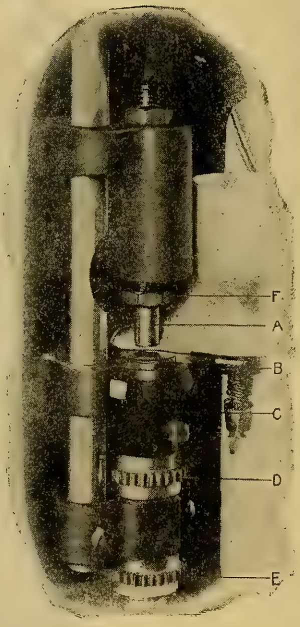
Fig. 733 illustrates a rotary tablet machine made by the Arthur Colton Company, of Detroit. The disk carrying the punches, and perforated to form the dies, revolves continuously, the tablets being discharged in enormous numbers, from 1200 to 1500 per minute. As the disk revolves the granular powder is fed into the opening in the die, this in turn is compressed as the upper and lower punches pass between revolving wheels, and the tablet is subsequently ejected. Every action is automatic after the machine has been adjusted and the hoppers filled with granulation. One important feature in this type of tablet machine consists of the ease with which the degree of compression upon the tablet may be adjusted, *i.e.,* by simply moving a weight on a lever which applies the pressure, and also the fact that should the tablet become jammed in the die, or a double charge be introduced, there is no danger of breaking the machine as the weight which applies the pressure is lifted and the strain relieved at once.

Fig. 731



Eureka tablet machine

Fig. 732



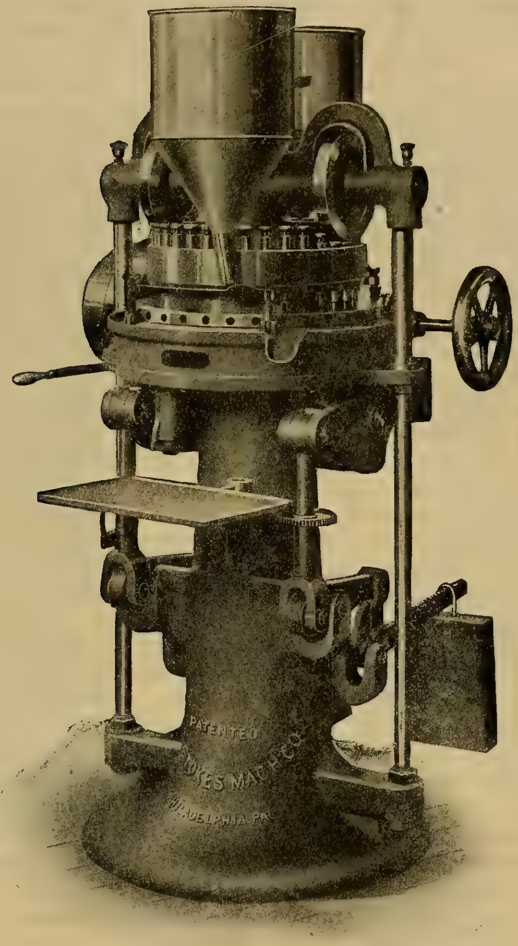
Eureka tablet machine (enlarged view of punches, etc.)

The punches and dies on compressed tablet machines require attention and care. For the best work they must be highly polished and kept free from rust or imperfections. When not in use they should be removed from the machine, thoroughly cleansed, and then coated with petrolatum.

In running tablets of mercuric chloride or other corrosive substances, the granulation should be kept as dry as possible and the punches and die must be frequently oiled.

Adjusting the Punches and Dies.—The correct adjustment of the punches and dies in the machine is an important part of the knowledge required for tablet manufacture. On the usual type of machine the lower punch is first fastened in the socket, then the die put into place in the bed of the machine, and the set screw, holding it in position, tightly fastened. The upper punch is now slipped into place, the machine turned over so that the punch enters the die, and then it is fastened. If the upper punch is tightened in its socket, when not entered in the die, it may strike the side when the machine is turned over and injure both punch and die. Having fastened the die and punches, the lower punch is now adjusted so that when it rises to the highest point it will be exactly flush with the top of the die. If it rises above the face of the die, the shoe which throws off the tablets and afterwards feeds in the granulation, would strike it and injure the punch, and probably jam the machine. On the other hand, if the punch, when it rises to the highest point for the ejection of the tablet, remains below the face of the die, the mechanism

Fig. 733



Rotary tablet machine

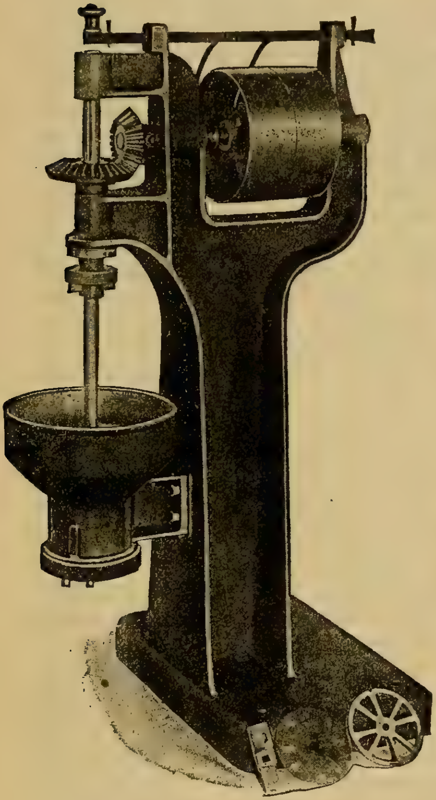
which throws off the tablet will cut the tablet in half. The lower punch must next be adjusted so that the cup-like opening in the die, produced by the punch dropping to the lowest point, will hold exactly the weight of granulation required for each tablet. This is determined by weighing out the amount of granulation for one tablet, say three grains, dropping the punch to the lowest point and pouring in the granulation. It should exactly fill the opening and remain flush with the top of the die, corresponding to the condition when the granulation is deposited by the feeding mechanism passing over the die. If the granulation will not all enter the opening, the punch must be lowered, and, if the opening is not completely filled, the punch must be correspondingly raised. The next step is to regulate the pressure; this is determined by the position of the upper punch. The opening in the die is filled with the required weight of granulation and the machine is slowly turned over, by hand, until the upper punch compresses the tablet. If the punch is too long, the machine jams and the fly-wheel cannot be turned, while if too short the tablet will be soft. Its length is therefore adjusted until the tablet possesses that consistence which is recognized as giving the necessary firmness without extreme hardness. A tablet of proper consistence may be readily broken in half between the thumb and fingers, but will not break when dropped upon the floor. The feeding device is now put into place and the granulation poured into the hopper, and the machine started. The weight of the tablets should be carefully checked from time to time by taking the weight of a multiple of tablets, say ten or more.

As the tablet is thrown from the machine it is always accompanied with more or less powder or uncompressed granulation. Various plans have been proposed to free the tablets from this powder, the most common being the sifting of the tablets. Sometimes the tablet, as it leaves the machine, is made to slide down an inclined trough which is made partially of coarse sieve cloth, the powder is thus collected before the tablet reaches the container.

In making compressed pills and lozenges, it must not be supposed that most powders which are to be compressed need no previous treatment. Both experience and knowledge are necessary to always achieve success. Some powders are too dry, and need moisture before they can be compressed; others are too damp, and need drying; others have so little cohesive property that even the application of a powerful press is insufficient to keep them from splitting or breaking; others again possess too great a tendency to adhere to anything with which they come in contact. The manufacture of compressed pills and powders has developed a special knowledge of the properties of medicinal substances which is very valuable to those who operate tablet machines.

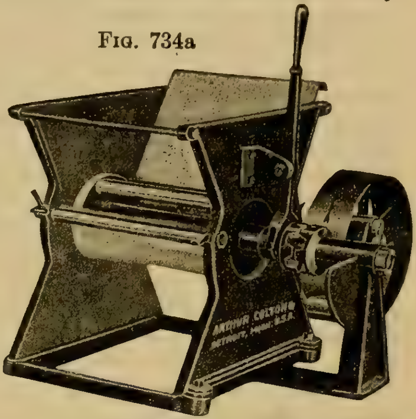
Granulation.—It has been found that most materials compress more satisfactorily in granular form than when in fine powder. This is partially due to the interlacing of the irregular edges of coarse granules, also in part to the fact that a granular powder permits the air pockets to escape from the tablets as they are being compressed. A granular powder also feeds into the die more uniformly than does a powder, as it does not pack so readily. Fine powder must always be sifted out of the granulation as it settles to the bottom of the hopper as the feeding apparatus vibrates, and causes the first run of tablets to be heavier than the last lot. Some chemical salts which are desired in tablet form and which may be obtained as granular powders, require no special treatment before compression. Tablets of potassium chlorate are made without trouble. Sodium bicarbonate, which is obtainable in a granular form, is compressed very frequently, and it is used in making the so-called soda mint tablets, the oil of peppermint being sprayed over the granules just before compressing, 1 to 1½ per cent. being the usual amount.

Fig. 734



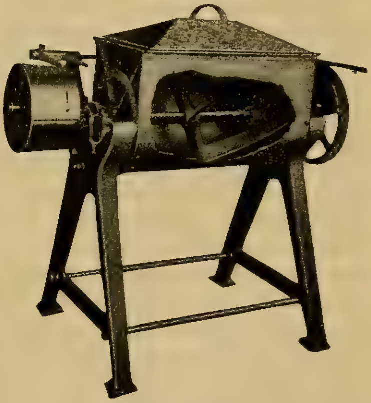
Stoke's wet granulating machine

Fig. 734a



Colton's oscillating sifter or granulator

Fig. 734b



Colton's mixer

Other salts, such as ammonium bromide, iodide, or chloride, hydrated chloral, potassium or sodium bromide, or iodide, potassium permanganate, etc., may be compressed without other treatment than sifting and possibly the addition of a lubricant. If salts are only obtainable in large crystals, they may be ground and sifted so that a No. 20 powder is available.

When tablets are to be made from other substances or when combinations of several medicines are desired in tablet form, they must be prepared as a granular powder.

Ingredients for Compressed Tablets.—The medicinal ingredients are of first consideration. The treatment of a granular chemical, to be compressed by itself, has already been considered. If chemicals or vegetable drugs are ingredients in a formula, they must be dried and finely powdered. If a fluidextract or tincture enters the tablet, they should be added to an inert diluent or one of the other ingredients, and the mixture dried and powdered. If the medication is an extract, it may be softened with a suitable solvent, and treated like a fluidextract or used as an excipient. Oxidizable substances may be mixed with inorganic diluents like talc or kaolin if the tablet is not to be dissolved or, if soluble tablets are required, with dried and powdered sodium sulphate or magnesium sulphate. Mercuric chloride is usually diluted with an equal volume of sodium or ammonium chloride, which greatly increases its solubility. Volatile oils are sprayed or poured over the finished granules just before compression and then serve also as a lubricant.

Diluents.—Inert substances are often required in a formula to increase the weight of the tablet. For this purpose cane sugar, milk sugar, or mixtures of the two are most often used. Cane sugar alone sometimes causes "capping," *i.e.*, the top of the tablet adhering to the upper punch. Sodium or ammonium chloride in mercuric chloride tablets and the inorganic substances named above, for oxidizable substances, are classed as diluents.

Disintegrators.—When compressed tablets were first made much difficulty was experienced from the fact that they often failed to dissolve or disintegrate. This has been largely overcome by the introduction of starch into the formula, which, if dried at 100° C. (212° F.), has great affinity for water and swells notably, bursting the tablet apart. It is sometimes introduced as a paste, made by boiling together 150 Gm. of acacia, 100 Gm. of starch, 475 mils of water, and 2 Gm. of sodium benzoate. This serves as an excipient and when the granulation has been dried, the starch acts as a disintegrator. Most frequently, however, the dried starch is added directly to the granulation just before compressing. From 5 to 20 per cent. may be added as required. Effervescent mixtures have been used as distintegrators; sodium bicarbonate and citric or tartaric acid in molecular proportion, but are not generally applicable. They are used it lithium citrate tablets and sometimes in hypodermic tablets.

Trituration.—The ingredients, all thoroughly dried and in fine powder, should be thoroughly mixed; the principles of trituration being applied, *i.e.*, an equal bulk of diluent added to the most active ingredients, this thoroughly triturated, again an equal bulk of diluent added, and the mixture triturated, and so on, alternately adding diluent and triturating, until all are mixed. In a small operation a mortar and pestle may be used, on the large scale the jar or pebble mills (see pages 195 and 196), or a mechanical mortar are preferable.

Excipients.—The character of the mixture determines the excipient to be used. It is not intended that a mixture of pill-mass consistence shall be formed, but there must be sufficient adhesion to cause the particles to roll into a moist, granular powder. If sugar is present, water is often sufficient; sometimes syrup, mucilage of acacia, or starch paste is required; alcohol forms an excellent excipient if resins are present, and at times extracts, if in the formula, give the necessary consistence. The uniform moistening of the mixed powders is accomplished with a mortar and pestle, on a small scale, but with large lots of material, in a mixing machine (see Fig. 734b), or a granulating machine (see Fig. 734) should be used. Glycerin should never be used as an excipient as the tablets would be hygroscopic.

Preparing the Granulation.—The moist mixture, which should not be a mass, is now forced through a sieve, which may be made by tacking No. 20 brass sieve cloth on a strong wooden frame. The moist powder is forced through the sieve with the aid of a block of hard wood, and in conducting this operation it is best to rub small portions of the powder, under the block, at a time, as difficulty will be experienced in forcing it through the sieve if the attempt is made to handle a thick stratum of the moist powder. The granulating machines shown in Figs. 734 and 734a may be used to advantage on the large scale. After the powder has been passed through the sieve it is dried in shallow trays in a closet in which warm air circulates (see page 185), or in a vacuum drier (see Fig. 141, page 154), and when perfectly dry, again passed through a No. 20 sieve, and the finer particles sifted out. Sometimes granulations finer than No. 20 are required, especially for punches carrying monograms, designs, or lettering.

Lubricants.—In practice it has been found desirable to use some substance as a lubricant when the tablets are compressed, otherwise they are apt to stick to the punches or die and cause much annoyance. Purified talc has been extensively used for this purpose in amounts from one to five per cent. It is usually sifted upon the granular powder just before passing it through the machine. It is not suitable for tablets which are to be dissolved, to form a clear solution, nor is its use permitted under the Food and Drugs Act for confections, like mint tablets, or for foods. Boric acid is usually used for soluble tablets, from two to five per cent. Liquid petrolatum is largely employed as a lubricant. It is added directly to the granules and they are then turned over until it is uniformly distributed. Two fluidrachms per pound is about the usual amount required. Cacao butter, incorporated in the granulation and stearic acid in ethereal solution, sprayed over the granulation, have also been recommended as lubricants. Benzoic acid is useful in the compressing of effervescent lithium citrate tablets.

Constructing a Formula.—While any system of weights may be used for the formula, it is customary in this country to calculate the original formula on the basis of 7000 tablets, and to employ avoirdupois weights, the system most extensively used in the buying of drugs and chemicals; the pound containing 7000 grains.

The following illustration shows the advantage of this plan: Suppose tablets were to be made each containing 1½ grains of acetanilid, 1 grain of quinine sulphate, and 1/16 grain of codeine, the formula could be set down as follows:

Ingredients	In each tablet	For 7000 tablets
Acetanilid	1 1/2 gr.	1 1/2 ℔ av.
Quinine Sulphate	1 gr.	1 ℔ av.
Codeine	1/16 gr.	1 oz. av.
Diluent		
Disintegrator		
Excipient, of each, a sufficient quantity,		
To make	5 gr.	5 ℔ av.

The material necessary for 7000 tablets is thus seen at a glance and the amount for any other number may be readily calculated. Finally, in summarizing, emphasis should again be laid upon the fact that each tablet must carry the amount of medicinal ingredients claimed for it. This requires thorough distribution of the several ingredients when the mixture is triturated and uniformity in the size of the tablets as they are compressed. Equally important is the requirement that all tablets readily dissolve or at least disintegrate, and therefore become medicinally efficient.

The only official tablet is the antiseptic "Bichloride Tablet," and this was given official standing for the purpose of establishing uniformity in shape and color, to avoid the danger from poisoning which has occurred through their being mistaken for harmless tablets. The Pharmacopœia specifies a tablet of angular shape and this permits the several manufacturers to exercise originality in designing their own tablets but yet makes them distinctive. A form much used has been the "coffin" shape, others use the diamond, and in one commercial form the tablets are all fastened to a piece of twine which must be cut to permit their use. The German Pharmacopœia requires that each tablet shall be cylindrical in shape and wrapped individually with black paper, upon which is printed the word "poison" and the skull and cross-bones. Another tablet now offered on the American market contains volatile oil of mustard, so that the user is expected to be instantly impressed by the odor and rendered cautious. The official titles, description and assay are as follows:

TOXITABELLÆ HYDRARGYRI CHLORIDI CORROSIVI. U. S. Poison Tablets of Corrosive Mercuric Chloride

[**Toxitabel. Hydrarg. Chlor. Corr.**—CORROSIVE SUBLIMATE TABLETS
BICHLORIDE TABLETS.]

Tablets of an angular shape (not discoid), each having the word "POISON" and the skull and cross-bones design distinctly stamped upon it. Each tablet weighs about 1 Gm. and contains not less than 0.45 Gm. nor more than 0.55 Gm. of corrosive mercuric chloride ($HgCl_2$); the remainder consisting chiefly of sodium chloride ($NaCl$). The tablets are to be colored blue, preferably with sodium indigotindisulphonate. Poison Tablets of Corrosive Mercuric Chloride are to be dispensed in securely stoppered glass containers on the exterior of which is placed a red label bearing the word "POISON" and a statement indicating that the Tablets contain the required amount of corrosive mercuric chloride.

Assay.—Proceed as directed under Hydrargyri Chloridi Corrosivum, using one tablet and washing the sulphide with distilled water until the filtrate is colorless and 5 mils of the washings acidulated with nitric acid, yields no turbidity on the addition of a few drops of silver nitrate T.S.

The weight of the mercuric sulphide obtained, multiplied by 1.167, indicates its equivalent in corrosive mercuric chloride.

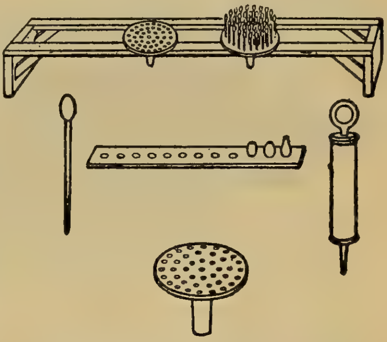
Tablets of Corrosive Mercuric Chloride may also be assayed as directed under the Electrolytic Method (see U. S. P., Test No. 4, Chapter LXII).

Each tablet shows not less than 0.45 Gm. nor more than 0.55 Gm. of $HgCl_2$.

GELATIN CAPSULES AND PEARLS

The gelatin coated pill is not the only form in which nauseous or bitter medicines may be administered with their taste concealed, gelatin capsules having been in use for many years.

FIGS. 735, 736, 737, 738, 739



Apparatus for making and filling capsules

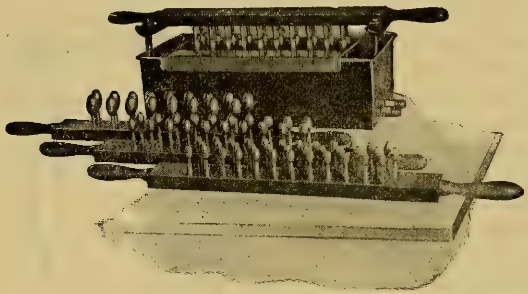
Gelatin capsules are of three kinds, designated as hard, soft, and empty. The first two are used in administering liquids. Empty capsules may be used for liquids, but they are generally employed in concealing the taste of bitter solids.

Hard and Soft Gelatin Capsules.—The principle upon which they are made is that of dipping a smooth mould, usually of bone, ivory, brass, or white metal, into a thick, hot solution of gelatin, allowing the film to become cold, removing it at the proper time, filling it with the liquid, and then sealing it.

Figs. 735, 736, 737, 738 and 739 illustrate the method of making and filling capsules. The process is not new, and the theory is simple, but success in making capsules is not apt to crown the first efforts, considerable experience being necessary.

The material employed for the shells or envelopes of soft, elastic capsules is a composition of gelatin and glycerin, the proportions being varied according as a softer or a harder capsule is desired. A sufficient quantity of water is employed in making the composition to produce a fluid which shall be of the proper consistence. No exact formula can be strictly adhered to, because the proportion will vary with different samples of gelatin; but after a little experience the operator learns to adjust it to a nicety. The solution must be kept at a uniform temperature—about 40° C. (104° F.) by means of a water bath, and as this temperature would promote the development of bacteria and hasten decomposition if precautions were not taken, it becomes necessary to add sulphur dioxide as a preservative. The U. S. P. IX has recognized this and permits 0.15 per cent. of sulphur dioxide in the gelatin for capsules. A wooden mould, or one made of brass or white metal, having a stem about four inches in length (see Fig. 735), is employed for forming the shell. A number of these moulds are fixed in the perforated wooden disks, and when in use these disks are supported on a simple frame or rack, consisting of two parallel strips of wood about four inches apart. The moulds must be slightly oiled to prevent the composition from adhering to them; but excess of oil must be avoided, or they will refuse to take the gelatin. The operator takes one of the disks from the rack by its handle, inverts it, and dips the mould carefully into the gelatin composition, then withdraws it slowly with a steady motion. The moulds are now held in a current of cold air, produced by a fan or other suitable device, and are kept in constant motion by the operator to secure an even distribution of the gelatin until it is sufficiently congealed, when the disk is returned to its place, and the operation is repeated with a second disk. When the gelatin is hard enough to be handled without sticking to the fingers, the disk is taken to a table, and by a smart rap with the hand the moulds are shaken out of their sockets. An operator provided with an ivory knife next separates the capsule from the superfluous gelatin which has adhered to the stem of the mould, and the soft, elastic shell is then pulled from the mould.

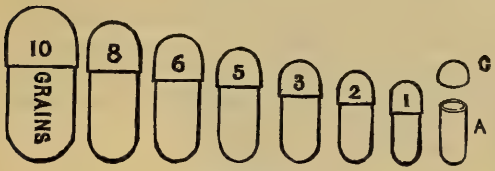
Fig. 740



Stokes's gelatin capsule apparatus

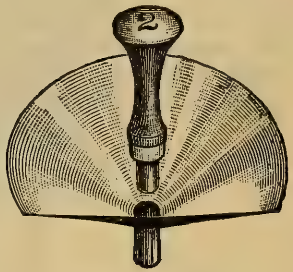
The capsules are filled by the skilful use of a syringe burette or, on the small scale, with a medicine dropper. Great care must be taken that oil does not touch the edge of the capsule, since such an accident would render it impossible to seal the capsule. There is less danger of soiling the edge of the capsule if the outside of the dropper or nozzle is wiped clean with absorbent cotton and then inserted entirely within the capsule before the oil is allowed to flow, than if the attempt is made to drop the oil into the opening of the capsule. The final operation of sealing is accomplished by passing over the opening a small glass rod or brush, or a loop of wire, carrying the warm glycerin-gelatin solution used for the sealing (see page 1780). When using this solution it must be thinned with water until it loses all tendency to form a thread of gelatin as the sealing is attempted, otherwise the cap will be pulled off again by the rod or wire as it is lifted from the capsule. When the capsules are thus finished, they are allowed to stand a few hours on the supporters to dry, and are then spread out on a sheet of white paper in order to detect any that may be imperfectly sealed. These having been removed, the capsules are ready to be packed in boxes for the market. The composition of hard capsules differs from the elastic ones only in the omission of glycerin. They are now manufactured by the use of intricate machinery on an enormous scale and are so perfect and uniform that the caps rarely fail to fit satisfactorily. In sealing hard capsules (see Fig. 741), filled with liquids, the cap or larger end should be pressed upon a small mass of absorbent cotton in a pan or dish, the cotton being saturated with water of boiling temperature or with diluted alcohol. The cap is then quickly placed upon the other end of the capsule and given a rotary motion until it adheres. Care must be taken to avoid an excess of water or moistening it beyond about one-eighth of its length, else the cap will collapse. It should be remembered that gelatin is not soluble in cold water and therefore imperfect sealing results if hot water is not used.

Fig. 741



Empty capsules

Fig. 742



Davenport's capsule filler

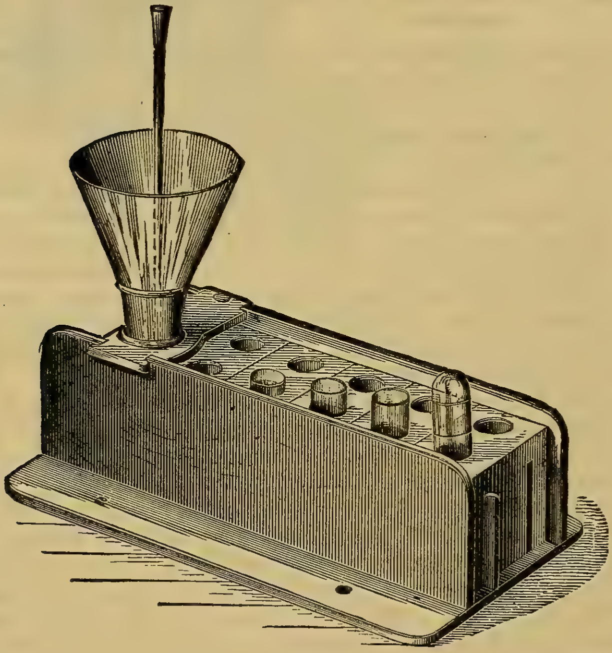
In the apparatus made by the F. J. Stokes Machine Company (see Fig. 740), the dipping bulbs are made of "white metal," and mounted on hardwood blocks.

Empty Capsules.—These are not ovoid in shape, but cylindrical (see Fig. 741). They are made of several sizes, and are usually designated by numbers. The smallest size in the illustration is represented with the cap, C, off. These are used by pharmacists for enclosing nauseous or bitter powders or masses and sometimes liquids. They are filled in several ways. One plan is to make a mass of the powders, divide it into little rolls, as in making pills, insert them in the larger end of the capsule, A, and place the cap, C, tightly upon it. To fill the capsules with powders several devices are employed. In the retail drug store for prescription filling the usual plan is to mix the ingredients by trituration, reducing all to a fine powder; place this upon paper and press it to uniform thickness. The capsule is then selected which will hold the required weight in the larger end when pressed firmly into the powder. This may be determined by an experiment, but the pharmacist soon becomes skilled in selecting the correct size. The cap is then removed, held in the left hand, and the larger end pressed into the powder, repeatedly, until it is filled. The cap is then slipped into place and the weight tested. If the powder is kept in a thin strata the capsule and fingers are only slightly soiled, but nevertheless the capsule should be carefully wiped with clean cheesecloth or shaken with clean granulated sugar to remove any bitter or disagreeable medication which may have adhered to the outside. Whitfield's capsule filler is an elaborate apparatus. Davenport's method is very simple (see Fig. 742).

Reymond's capsule filler consists of two blocks of hard wood. In one twelve sockets are bored of sufficient depth to enable the capsules to be inserted one-half of their length. The upper side of the upper block is provided with twelve funnel shaped receptacles of sufficient capacity to hold all the powder intended to fill the capsule, the lower end of these receptacles being so shaped that when the two sections are in proper position for use they will project just over the upper edge of the capsule. The under side of this section is provided with twelve holes a trifle larger than those in the lower block, and of sufficient length to cover that portion of the capsule projecting above the lower block. Pegs are inserted in either section to fit into corresponding holes in the other, so as to hold the two together in proper position when the filler is in use. A tampon is provided with which to pack the capsule.

A capsule filler made by the Parke, Davis Company is shown in Fig. 743. It consists of a metal frame holding a hopper and a block of wood having two slots cut lengthwise in it and perforated to hold the capsule; two triangular strips of metal (the higher ends of the strips being at the point farthest from the hopper) are fastened edgewise in the metal base so that they fit into the slots in the wooden block. The empty capsules having been placed in the perforations are filled from the hopper, and the block having been pushed to the right, the next capsule is filled, and so on, when the whole row is filled. The capsules after being capped are raised by the inclined metal strips so that they can be easily picked off.

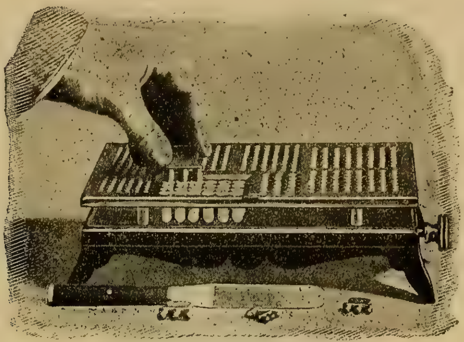
FIG. 743



Capsule filler

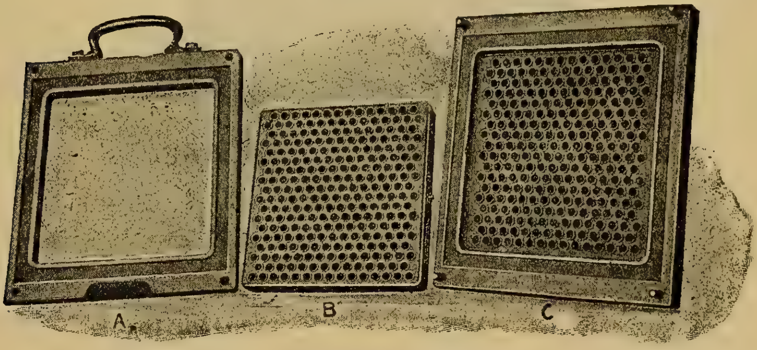
Ihrig's capsule filler is shown in Fig. 744, and consists of a stationary base with a square, polished, movable table containing perforations for holding the empty capsules; the table is raised and lowered by a thumb screw. The perforations are arranged in fields of sixty each for five sizes of capsules, and of fifty-six each for two sizes of capsules. The lower portion of the capsule should rest on the base at the beginning of the filling process, and the upper plate raised so that the top of the capsule is slightly below the surface of the upper plate. A metal bevelled square is next placed in proper position, as shown in Fig. 744, so as to exclude the perforations not in use from the capsules which are to be filled; the powder is then distributed over the capsules and pressed down by means of a metallic triple punch. When these are filled, the upper plate is lowered by turning the thumb screw, the cap adjusted, and the capsules are finished. Numerous other devices have been used for capsule filling on a large scale; they are usually operated upon the principles already explained. In one style of capsule filler the machine automatically removes the cap, presses the larger end into the powder repeatedly, until filled, replaces the cap, and finally cleans the outside of the capsule.

FIG. 744



Ihrig's capsule filler

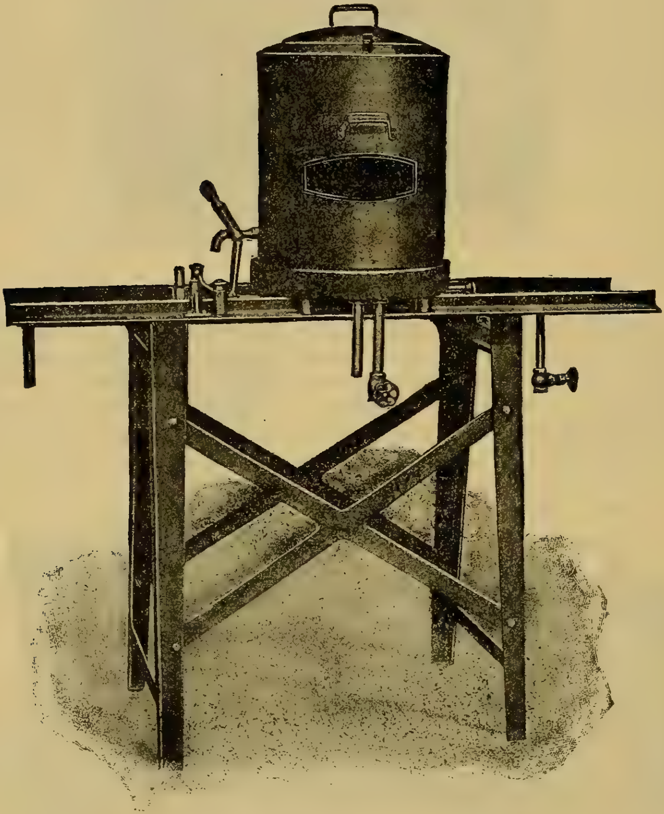
FIG. 747 FIG. 748 FIG. 749



Colton's pearl or globule mould

Pearls or globules differ from gelatin capsules in shape, being globular, and in being usually smaller in size. In addition, they show no air space, the gelatin shell being completely filled with the medicinal substance. Their preparation requires the use of special apparatus, and they cannot be profitably made on the small scale. The mixture of which the shell of the globule is composed consists generally of about the following formula: Gelatin, best grade, water-white, 10 pounds; acacia, 1 pound; glycerin, 1 gallon; water, 2 gallons. Heat the mixture on a water bath for twelve hours, maintaining the consistence by the addition of water as required, and then run into moulds to form the sheets, which should be about one-sixteenth of an inch in thickness.

Fig. 750



Colton's pearl or globule leaf making machine

A pair of moulds which are termed upper and lower moulds are needed (see Figs. 747, 748, and 749). When the lower mould is placed upon a level surface, a leaf of gelatin (see Fig. 750) should be laid over the entire face of the matrix, extending out and over the edges of the frame which has previously been slightly heated on the warming table; the gelatin leaf thus placed will soon conform itself to the various corners and ledges found in the frame; this is now ready to receive the liquid, of which a measured quantity has been previously placed in a graduate. This should be poured into the receptacle prepared for it; when this is done, the upper gelatin leaf is placed upon the liquid surface by slightly rolling it over and across the liquid; this is done to exclude every particle of air. The upper mould is now placed over the lower, through the guidance of dowel pins, and the "flask" is now ready for compression. It is placed upon the table of a press, where it is slid into position by the medium of guiding grooves, pressure is applied, and the table rises until the sealing point is reached; the table then returns to its place of starting. The moulds are now separated and the net containing the globules removed; the globules may be quickly extracted from the net, by catching it at opposite corners, and giving it a sudden stretching, repeating this at the remaining corners.

In order to make pearls or globules it is necessary to prepare the gelatin leaf or film very carefully, and of the required thickness. Fig. 750 shows Colton's leaf making machine, which consists of a jacketed copper tank in which the gelatin mixture is placed. This is supported on a grooved "warming" table, so constructed that receiving plates may slide smoothly upon it. The gelatin mixture is heated by turning on the steam to the copper tank, and the flow of the liquefied mixture upon the receiving plate is controlled by the faucet. Any excess is skimmed from the plate by an adjustable gauge, so that the thickness of the film or leaf can be fixed exactly. The film sets after cooling, and is placed in a seasoning kiln to secure the desired consistence for use in the pearl or globule mould.

Enteric Capsules.—There has been considerable demand in recent years for capsules which will not dissolve in the stomach but which will deliver their medication in the intestinal tract. The substances usually dispensed in this manner are sodium and zinc phenolsulphonate, as intestinal antiseptics, sodium salicylate, sodium carbonate, potassium iodide, creosote, oil of santalwood etc. Such capsules are termed enteric and various plans have been suggested to accomplish this purpose. *Salol coating,* which has been used for the making of enteric pills, has also been applied to hard capsules, with a fair degree of success. The coating is applied in the manner described under pill coating (see page 1763), but greater care is necessary to secure a complete coating, especially on the ends of the capsules. The capsule being flexible and the coating very brittle, it is necessary to handle them with care to avoid cracking off the coating, and in dispensing it is best to pack them in cotton in a box or vial.

Another suggestion has been the incorporation of the medicinal substance in a mixture of solids and fats, the following type formula being suggested:

Medication	0.6	Gm.
Prepared suet	0.3	Gm.
Paraffin	0.15	Gm.

Melt the fatty substances, incorporate the finely powdered medication, and insert into capsules of proper size.

Yet another form has been the so-called *glutoid capsules.* These are prepared by subjecting hard or soft capsules, containing the medication and carefully sealed, to the action of formaldehyde until they become insoluble in the stomach, but retain their solubility in the intestine. Excessive treatment will render them completely insoluble, and it has also been shown that the action of formaldehyde on gelatin is progressive, so that capsules so treated are apt to lose their solubility if kept too long. Scoville suggests their immersion for exactly thirty seconds in a one per cent. solution of formaldehyde, drying and holding for two weeks to allow the formaldehyde to act upon the gelatin, before dispensing. Such capsules have been found to remain enteric for at least a year, but if treated with stronger solutions or for a longer time they soon became insoluble. This process is adaptable for stock capsules. Capsules so treated should not dissolve within three hours when immersed in a 0.5 per cent. solution of hydrochloric acid containing a little pepsin, the temperature being maintained between 37° and 38° C. (98.6° and 100.4° F.), but after resisting the above treatment should dissolve within five hours when digested in a 0.5 per cent. solution of monohydrated sodium carbonate, maintained at the temperature named above.

An ingenious means of proving that the capsules are enteric is to prepare a test capsule containing a small quantity of calcium sulphide and methylene blue and subject it to the same formaldehyde treatment as the other capsules. The test-capsule is then taken and if a draft of soda water causes the experimentor to notice the odor of sulphide on the breath within an hour or two, it is demonstrated that the capsule has not been sufficiently treated and has dissolved in the stomach. If, on the other hand, the urine is not colored blue within a reasonable time the treatment has been too extended and the capsule has not dissolved in either the stomach or the intestine.

Suppositoria *Suppositories*

Suppositories are solid bodies intended to be introduced into the rectum, urethra, or vagina to produce medicinal action. Their form is usually conical, with a rounded apex, and their consistence should be such that, while they will retain their shape at ordinary temperatures, they will readily melt or soften at the temperature of the body. Oil of theobroma, or cacao butter, is the best base for suppositories, because it accurately fulfils both of the above requirements. It was first suggested in this connection in 1852 by Mr. Alfred B. Taylor, of Philadelphia. It is rarely necessary to raise the melting point of cacao butter by the addition of wax, spermaceti, etc., except in the warmest summer weather, or when phenol, camphor, chloral, the volatile oils, or similar substances form the medicating ingredients. Gelatin suppositories are made from a mass containing gelatin and glycerin, by soaking gelatin in water, draining off the excess, adding five parts by weight of glycerin to every twelve parts of soft gelatin, and heating in a water bath. The medicating substance is rubbed into a smooth paste with a small quantity of water or glycerin and added to the mass. The U. S. P. IX requires that the size of rectal suppositories be 2 Gm., or thirty grains, and has given the following directions for their preparation:

"Suppositories are solid bodies of various weights and shapes, adapted for introduction into the different orifices of the human body, and melting or softening at body heat. The vehicles usually employed are oil of theobroma, glycerinated gelatin, or sodium stearate.

"For suppositories made with oil of theobroma the following general processes may be employed:

"Take of
***The Medicinal Substance,** the prescribed quantity
Oil of Theobroma, grated, a sufficient quantity

"Reduce the medicinal substance, if dry, to a very fine powder, or, if an extract, soften it with an appropriate liquid, then mix it thoroughly in a mortar with about an equal weight of grated oil of theobroma, and incorporate the remainder of the oil of theobroma until a homogeneous, plastic mass is obtained, adding, if necessary, a small quantity of expressed oil of almond. Roll the mass on a graduated tile until a cylinder of the proper length is formed, divide this into the required number of equal parts, and with a spatula, or other mechanical aid, form them into the desired shape.

"If the process of cold compression is preferred, mix the medicinal substance in a suitable mortar with about an equal weight of grated oil of theobroma, as above directed, then thoroughly incorporate it with the remainder of the oil of theobroma, previously finely grated, chilling the mortar, if necessary, to preserve the pulverulent form of the mixture. Transfer the powdered mass to the cylinder of an appropriate suppository compresser (see Figs. 771 and 772) and by the use of this apparatus prepare the desired number of compressed suppositories.

"If the process of fusion is preferred, mix the medicinal substance with about an equal weight of grated oil of theobroma, as above directed, then thoroughly incorporate it with the remainder of the oil of theobroma, previously melted by a gentle heat, in a suitable vessel provided with a lip; then allow it to cool to about 38° C. (100.4° F.), and when the mixture begins to congeal, pour it immediately into suitable well-cooled moulds. Keep the moulds at a freezing temperature until the suppositories have hardened and are ready to be removed.

"For suppositories containing hydrated chloral, phenol, or other substances which soften the vehicle, raise the melting point of the oil of theobroma by the addition of from 10 to 15 per cent. of spermaceti, but the melting point must not be raised above 37° C. (98.6° F.).

"For suppositories made with glycerinated gelatin the following process may be used:

'Take of
***The Medicinal Substance,** the prescribed quantity
Glycerinated Gelatin
Glycerin
Water, each, a sufficient quantity

"Mix the medicinal substance, if solid and soluble, in water or glycerin, or if a miscible liquid, with a little water, and add sufficient glycerin to make the weight of the mixture one-half that of the finished mass. Then thoroughly incorporate it with an equal weight of melted glycerinated gelatin, and pour it at once into suitable moulds which have been greased with a small quantity of petrolatum. Cool the moulds thoroughly before removing the suppositories. Moulds for urethral suppositories should be warmed sufficiently before pouring the mass to facilitate the proper filling of the mould. Suppositories having a firmer consistence may be prepared by substituting mucilage of acacia for a portion of the water or glycerin.

"If the medicinal substance is insoluble in water or glycerin, thoroughly levigate it in a warm mortar with a sufficient quantity of glycerin to make the weight of the mixture one-half that of the finished mass. Then thoroughly incorporate it with an equal weight of melted glycerinated gelatin, and pour it into suitable moulds as above directed. With bulky powders about one-half of the glycerin may be replaced with water before levigation.

"Glycerinated gelatin suppositories should be protected against the effects of heat, moisture and dry air by keeping them in tightly-closed containers in a cool place.

"*Rectal Suppositories* should be cone-shaped, and when made from oil of theobroma should weigh about 2 Gm. [old form about 30 grains].

"*Urethral Suppositories* (*Bougies*) should be pencil-shaped, pointed at one extremity, and either 7 cm. [2.7 inches] in length, weighing about 2 Gm. [old form about 30 grains] or 14 cm. [5.5 inches] in length, weighing about 4 Gm. [old form about 60 grains], when made with glycerinated gelatin. If prepared with oil of theobroma they should weigh about one-half the above quantities.

"*Vaginal Suppositories* should be globular or oviform in shape, and weigh about 10 Gm. [old form 154 grains] if made with glycerinated gelatin, and about 4 Gm. [old form about 60 grains] if made with oil of theobroma."

GELATINUM GLYCERINATUM. U. S. Glycerinated Gelatin

[Gelat. Glycerin.]

	Metric	Old form
***Gelatin**	100 Gm.	4 oz. av.
Glycerin	100 Gm.	4 oz. av.
Water, a sufficient quantity,		
To make	200 Gm.	8 oz. av.

Pour upon the gelatin sufficient water, which has been previously boiled and cooled, to cover it; allow it to stand one hour; pour off the water and allow the gelatin to drain for a few minutes; then transfer it to a dish, add the glycerin, and heat it on a water bath until the gelatin is dissolved. Strain the solution while hot, transfer to a tared dish, and continue to heat on the water bath until the product weighs 200 Gm. [old form 8 oz. av.]. When cold, cut the mass into pieces, and preserve them in well-closed containers.

N. F. Preparations.—Glycerogelatinum Acidi Salicylici, Glycerogelatinum Iodoformi, Glycerogelatium Zinci Durum, Glycerogelatinum Zinci Molle, Suppositoria Boroglycerini.

SUPPOSITORIA GLYCERINI. U. S. Suppositories of Glycerin

[Supp. Glycerin.]

	Metric	Old form
***Glycerin**	30.0 Gm.	1 oz. av. 26 gr.
Monohydrated Sodium Carbonate	0.5 Gm.	8 gr.
Stearic Acid	2.0 Gm.	31 gr.
Water	5.0 mils	81 min.
To make ten rectal suppositories	10	10

Dissolve the monohydrated sodium carbonate in the water and add it to the glycerin contained in a suitable vessel placed in a water bath in such a way that the vessel is well down in the boiling water and its contents protected as much as possible from the steam of the bath. Add the stearic acid and heat the mixture for fifteen minutes or until the carbon dioxide ceases to be evolved, and the liquid is clear. Then pour the melted mass into suitable moulds, remove the suppositories when they are completely cold, and preserve them in tightly-stoppered glass vessels in a cool place.

SUPPOSITORIA BOROGLYCERINI. N. F. Suppositories of Boroglycerin

[Suppos. Boroglycer.]

	Metric	Old form
Glycerinated Gelatin	20 Gm.	309 gr.
Glycerite of Boroglycerin	15 Gm.	231 gr.
Glycerin	15 Gm.	231 gr.
To make twelve rectal suppositories.		

Melt the glycerinated gelatin on a water bath, add the glycerite of boroglycerin and glycerin and mix well. Pour the uniform mixture into well-oiled moulds of the required size, which should be slightly warmed, and allow it to stand until the suppositories are firm. Dispense the suppositories in glass containers.

Unofficial Suppositories

Name	Ingredients	Preparation
Suppositoria Acidi Carbolici. Br.	0.8 Gm. Phenol; 0.5 Gm. White Beeswax; sufficient Oil of Theobroma to make 12 suppositories, each weighing about 1 Gm.	Dissolve the Phenol in the previously melted Oil of Theobroma and Beeswax, and pour into suitable moulds to form 12 suppositories
Acidi Tannici. Br.	2.4 Gm. Tannic Acid; sufficient Oil of Theobroma to make 12 suppositories, each weighing about 1 Gm.	Mix the Tannic Acid with the melted Oil of Theobroma, with trituration, and pour into suitable moulds to form 12 suppositories
Belladonnæ. Br.	1.7 mils Liquid Extract of Belladonna; sufficient Oil of Theobroma to make 12 suppositories, each weighing about 1 Gm.	Proceed as in Tannic Acid suppositories
Iodoformi. Br.	2.4 Gm. Iodoform; sufficient Oil of Theobroma to make 12 suppositories, each weighing about 1 Gm.	Proceed as in Tannic Acid suppositories
Morphinæ. Br.	0.2 Gm. Morphine Hydrochloride; sufficient Oil of Theobroma to make 12 suppositories, each weighing about 1 Gm.	Proceed as in Tannic Acid suppositories
Plumbi Composita. Br.	2.4 Gm. Lead Acetate; 0.8 Gm. Opium; sufficient Oil of Theobroma to make 12 suppositories, each weighing about 1 Gm.	Proceed as in Tannic Acid suppositories

Suppositories are usually of three kinds: 1. Rolled. 2. Moulded. 3. Pressed.

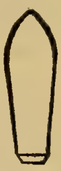
1. **Rolled suppositories** are made by a very simple method. The cacao butter is scraped or grated and placed in a mortar; the medicating ingredients are reduced to powder, or, if composed of extracts, are softened with water and rubbed until a smooth paste is formed; a mass resembling a pill mass is now made by thoroughly incorporating the ingredients with a pestle, and, having thoroughly dusted a pill tile with lycopodium or starch, a suppository cylinder is formed by rolling the mass upon the tile with a spatula, after having softened it by partly shaping it with the fingers. If the mass is brittle, it may be softened by thoroughly incorporating a few drops of olive oil, petrolatum or wool fat with it; the cylinder is rolled out and then cut into the proper number of pieces with a spatula; the conical shape is given by rolling *one end* upon the tile with a spatula, so as to produce a rounded point. In warm weather it is necessary to use lycopodium, starch, or a similar absorbent powder freely. With practice, excellent rolled suppositories can be made. This method has the substantial merit of requiring very little apparatus, but considerable skill is needed to produce suppositories equalling in finish those which are moulded (see page 1783).

2. **Moulded suppositories** are more largely used than any other kind; preference is given to them because of their more finished appearance. For the U. S. P. IX directions, see page 1783.

The principle upon which suppositories are moulded depends upon the fact that the mass after being introduced into the moulds contracts upon cooling; when the limit of contraction is reached, the suppository is a trifle smaller than the mould in which it has been made, and it can be easily extracted; hence the importance of allowing the moulds to become thoroughly cold after the introduction of the melted mass. The novice almost invariably makes the mistake of opening the divided moulds too soon (before the limit of contraction is reached); the suppository sticks to the mould, and splitting ensues. The difficulties encountered in making moulded suppositories generally arise from the use of too much heat in melting the mass. A suppository mass containing an extract bears some analogy to an emulsion, with the proportions of the ingredients reversed; the fatty substance here is in great excess; the extractive matter is the substance to be uniformly suspended, while the water is relied upon to effect this object; this can be done by making the extract into a soft paste with the water, and gradually incorporating it with the partly melted cacao butter by stirring.

Other difficulties in moulding suppositories are easily overcome by the exercise of judgment and knowledge of physical laws. A defect frequently seen in the finished cacao butter suppository is that the surface is not always perfectly smooth. This may arise from several causes. Sometimes ridges are seen traversing the suppository; these are usually produced by overcautiousness, the operator pausing in pouring the melted mass into the mould, then pouring in a little more, then pausing again, and so on. On taking out the suppository, a ridge will be found at each spot where a pause was made. The remedy for this is to keep on pouring steadily when this part of the process is reached. Other defects are pitting and an imperfection in the formation of the summits of the suppositories. The pitting is caused by drops of water which have been allowed to remain upon the sides of the mould; the imperfect summits are due to water which has not been shaken out of the mould before pouring in the melted mass. Still another defect is a conical hole in the centre of the base of each suppository. This is due to not overflowing the moulds so as to leave an excess of mass upon the top. In all cases there should be a little more mass than will fill the moulds, and after cooling the excess can be cut off.

FIG. 752



Wellcome's suppository

If *strong heat is used*, the water is evaporated, the extract separates in small masses, and, like a bad emulsion, the mass is "cracked." The remedy is to pour it at once upon an ointment slab or tile, add a little water, and rub it until the original condition is regained.

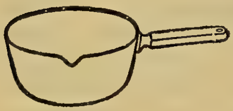
Henry S. Wellcome, of London, has devised an improvement in the shape of the moulded suppository which prevents the expulsion of the suppository after insertion; this consists in tapering the suppository at the base, and from there gradually expanding its width until near the top, which terminates in a blunt point (see Fig. 752).

Pouring the Mass.—The mass should be poured into the mould from a dipper held in the right hand, a vigorous stirring being maintained with a spatula held in the left hand immediately before the pouring begins; indeed, when heavy powders are directed, the stirring must not cease during the pouring, or the last suppositories will contain a larger proportion of the heavy powder than those which were first made. A porcelain casserole (see Fig. 753) is the best vessel to melt the mass in, and it is much better to dip it into a dish containing hot water than to use direct heat.

Fig. 754 shows a very convenient little tinned dipper (which may be made by any tinsmith) for pouring melted suppository mass; the shape of the lip and the handle are the parts which especially fit it for this purpose. The use of lycopodium to dust the inside of the moulds is unnecessary. If proper attention be given to cooling the moulds thoroughly, there will be no difficulty from the adhesion of the suppositories.

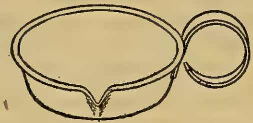
Suppository Moulds.—Many forms are in use. They may be arranged in three classes: 1. Individual moulds. 2. Divided moulds. 3. Hinged moulds.

FIG. 753



Casserole

FIG. 754



Suppository mass dipper

FIG. 755

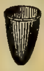


FIG. 756

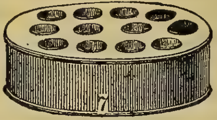
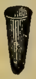


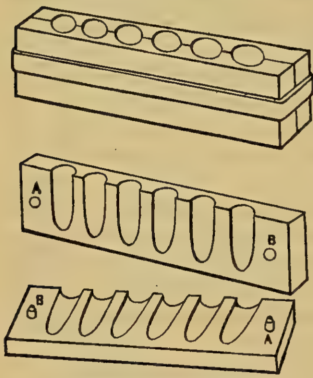
FIG. 757



Individual suppository moulds

1. *Individual Moulds* are those which were first employed. In this form an oval metallic dish is furnished with a lid which contains twelve circular perforations (see Fig. 756) for supporting twelve individual moulds made of white metal. To prevent the moulds from slipping through when they are placed in the perforations, they each have a shoulder, which rests upon the lid (see Figs. 755 and 757). The dish is nearly filled with chopped ice or snow, the lid supporting the moulds is placed in position, and the melted mass is poured in. After the suppositories have become thoroughly cold, they are removed by inverting the mould and tapping it lightly on a hard surface, when they usually drop out. They sometimes fail, however, to answer the summons promptly. This is generally due to the mould not being perfectly clean. The difficulty of quickly and easily cleaning these small moulds, and the liability of losing or misplacing them, constitute the most serious drawbacks to the use of this form.

FIGS. 758, 759

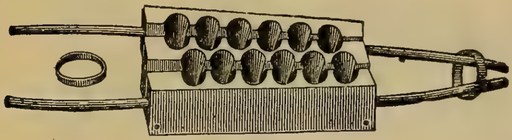


Divided suppository moulds

2. *Divided Moulds.*—This, at present, is a favorite kind of suppository mould, one of the advantages being the facility with which it can be cleaned. They are preferably cooled by placing them upon a piece of ice. The simplest form is shown in Fig. 758. The upper mould is represented as closed and ready for use, being held together by an ordinary rubber band. The open mould is shown below. It is made of brass, and consists of two parts,

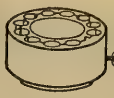
which are kept in position by placing the pins A and B in their respective sockets, see Fig. 759. This form is seen enlarged in the Wirz mould (see Fig. 760). This mould will make twelve suppositories at one time, and it is held together by two brass rings which are slipped over the handles. The circular forms have the very great advantages of requiring but a small piece of ice, and of being almost indestructible. Figs. 761 and 762 show See's mould. The central core, A, is held in position by a set screw. Fig. 761 represents the closed mould, and Fig. 762 shows the core when elevated. This mould is made by J. M. Maris & Co., of Philadelphia. The best divided mould is unquestionably that shown in Fig. 763. It was manufactured by L. R. Blackman, of Newport, R. I. The division of this mould is horizontal instead of perpendicular. It is made of gun metal, is nickel plated, contains no small working parts, and is compact and simple in its construction. The relative position of the upper and lower parts is shown in the illustration. When the suppositories have contracted sufficiently to leave the mould easily, it may be known by pressing one of them slightly upon the top. If it can be moved downward slightly, it indicates that they are loose, when the upper part, carrying the suppositories, may be separated by lifting it from the lower part; it is then inverted over a piece of paper, when a light tap will cause the suppositories to drop out.

Fig. 760



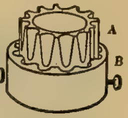
The Wirz suppository mould

Fig. 761



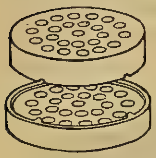
See's mould (closed)

Fig. 762



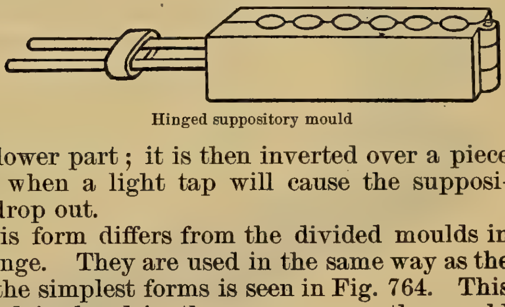
See's mould (open)

Fig. 763



Blackman's suppository mould

Fig. 764

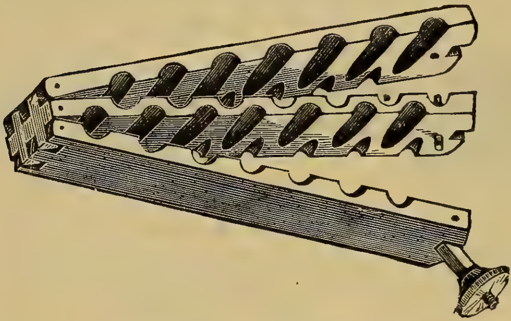


Hinged suppository mould

3. *Hinged Moulds.*—This form differs from the divided moulds in being connected with a hinge. They are used in the same way as the divided moulds. One of the simplest forms is seen in Fig. 764. This opens perpendicularly, and is closed in the same way as the mould shown in Fig. 760. Benton, Myers & Co.'s mould (Fig. 765) is constructed so that two different sizes of suppositories may be made in it. It is in addition a double mould, is hinged at one end, and closed by a screw catch at the other. Figs. 766 and 767 are illustrations of a very serviceable English mould, recommended by Mr. Henry B. Brady, of Newcastle-on-Tyne. It differs from all others in being hinged at the bottom. It is held together by two screw catches, one at each end. Fig. 767 shows this mould closed, and in position upon a cake of ice. Fig. 768 shows Colton's mould for making glycerin suppositories. The manner of using it is similar to that of the pre-

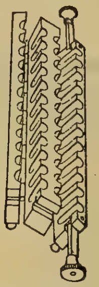
ceding moulds. It makes a double pointed suppository, as shown in the illustration. Moulds for making gelatin suppositories with a rounded end, as shown in Fig. 768, are also made by Arthur Colton, of Detroit. In Fig. 769 is shown the Stokes suppository mould for making forty-eight suppositories at one filling.

Fig. 765



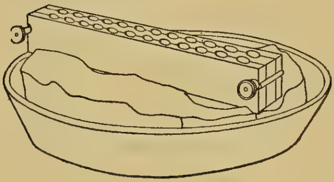
Benton Myers & Co.'s suppository mould

Fig. 766



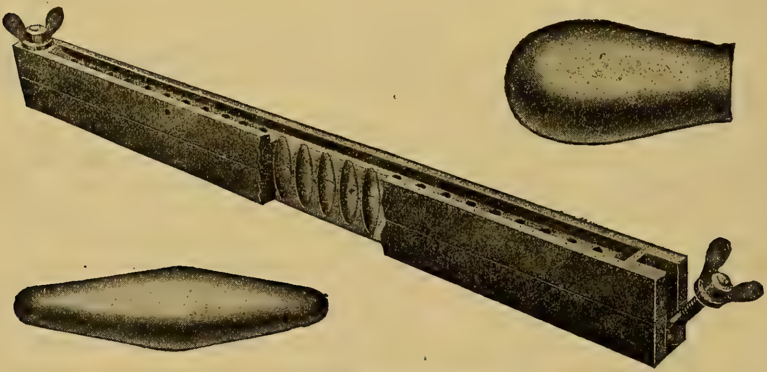
Brady's suppository mould

Fig. 767



Brady's suppository mould on ice

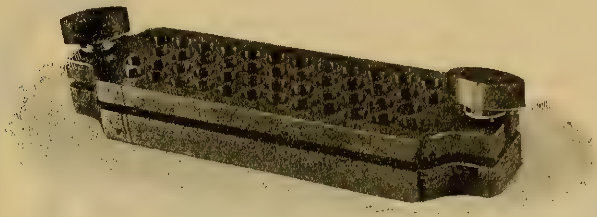
Fig. 768



Colton's glycerin suppository mould

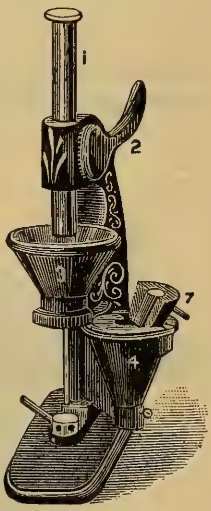
Compressed Suppositories.—The method of making suppositories by compression has been used to some extent, but the expense of the apparatus required in their production at one time constituted a serious drawback. A. M. Knowlson, of Troy, N. Y., made an effective suppository machine, which pressed the mass through a cylinder into a mould, and finally discharged the well finished suppository, without the use of any heat whatever. In Archibald's suppository machine the compression is effected by a lever working perpendicularly in a cylinder containing a suppository mass. This apparatus is shown in Fig. 770. The suppository mass may be made in the usual way, or the medicating ingredient, if in powder, may be mixed with the grated cacao butter and thoroughly distributed through it. The proper mould (7) having been introduced in the swing bed (4), the latter is moved accurately into position under the hopper (3), and the plunger (1) having been elevated by moving the hand lever (2), the mass is introduced into the hopper (3). By pressing the hand lever (2) down the mass is forced into the mould. Without raising the lever the swing bed is then pushed around to the right, as shown in Fig. 770, and the mould lifted out by the handle (7). The suppository may be removed from the mould by gently sliding one of the halves over the other, for this gradually forces it out of the mould without the necessity of touching the suppository with the fingers. If the suppository adheres to the mould, it may often be forced out by a slight pressure of the thumb upon the apex. In warm weather the moulds should be cooled before using them by laying them upon ice or by immersion in ice water. Soap liniment, glycerin, or powdered talc have been used as applications to the inside of the moulds when the mass has a tendency to adhere. Moulds accompany the apparatus for making rectal, vaginal, nasal, and urethral suppositories, and any special size can be furnished by the manufacturer.

Fig. 769



The Stokes suppository machine

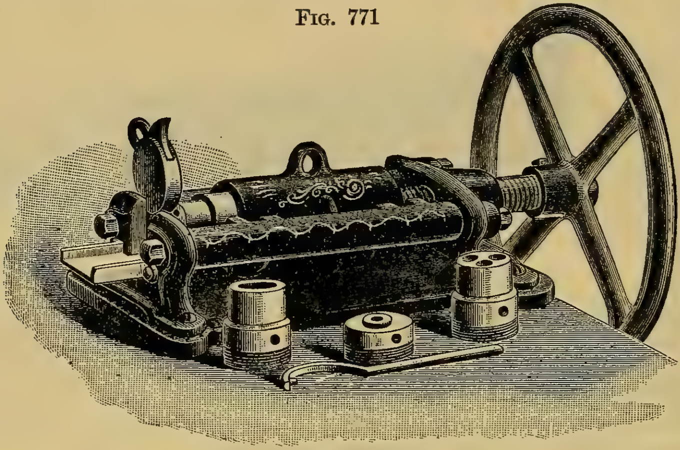
Fig. 770



Archibald's suppository machine

For making larger quantities of suppositories the Whitall Tatum Company furnish the machine shown in Fig. 771. It consists of a cylinder, which can be turned back to receive the charge of suppository mass, the proper mould having been previously screwed into its place. The cylinder is then returned to its position, and, the gate having been closed, pressure is made by turning the wheel. The gate being then lifted, a slight pressure suffices to force out the suppositories. Repeating the operation, it is obvious that the machine will turn out suppositories as long as any mass remains in the cylinder. Brass dies and a tube are furnished to make 15 grain, 30 grain, vaginal, urethral, or nasal suppositories. Urethral or nasal suppositories are made by screwing on the proper die and then pressing the mass through it. A long rod like suppository is thus forced out, which may be cut into suitable lengths.

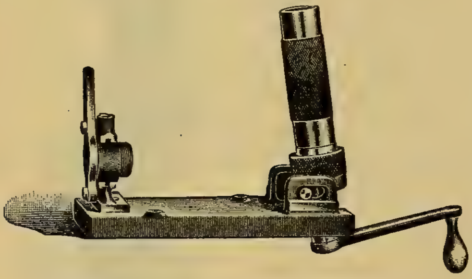
Fig. 771



Suppository machine

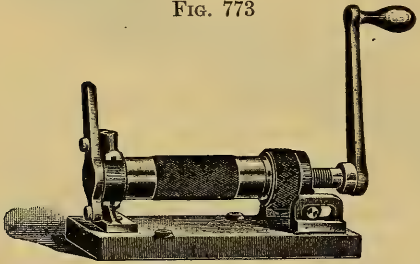
Gautier's suppository mould consists of a truncated metallic cone divided longitudinally into two parts, which fit accurately together by grooved surfaces. This cone is bored cylindrically for some distance, the diameter of the hole corresponding at this part with that of the wider end of a suppository, while at the upper end of it there is a female screw. Lower down it gradually tapers to a point, assuming the exact shape of a conical suppository. In use, the two parts of the cone are kept in position by an outer jacket of metal, which slips over them. The medicament having been well mixed with the previously grated cacao butter, the exact weight of the mass required in a suppository is introduced into the cylindro-conical opening through a small funnel. By means of a piston, which exactly fits the cylindrical part, and is constructed with a milled head and screw at the upper end, pressure is then applied, and the finished suppository may be released.

Fig. 772



Rapid fire suppository machine "open for charging"

Fig. 773

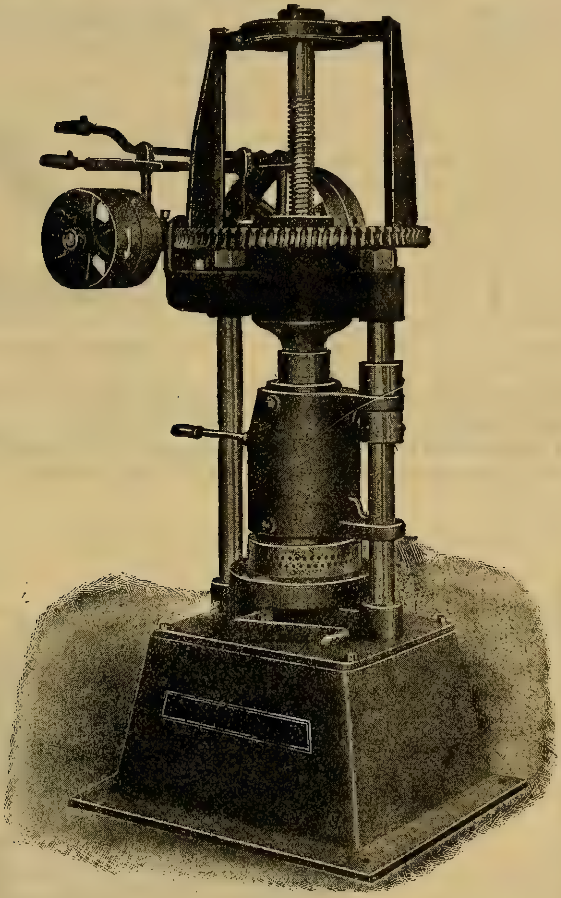


Rapid fire suppository machine "ready for action"

Figs. 772 and 773 show the rapid fire suppository machine. Its operation is similar to that used for the Whitall Tatum Company machine, over which it has some advantages. Fig. 772 shows the machine "open for charging," and Fig. 773 illustrates it when "ready for action."

Fig. 774 shows Colton's power suppository machine. It is adapted for making suppositories upon a large scale. It is different from the other machines on account of the device for cooling the mass in hot weather, the cylinder in which the mass is placed being surrounded with a jacket for holding iced water.

Fig. 774



Colton's power suppository machine

Suppositories are sometimes introduced into the rectum with difficulty. Figs. 775 and 776 show a suppositor to aid in their insertion. The tube is made of hard metal, and has a funnel shaped top (Fig.

776). The suppository is dropped into the tube (which should be slightly oiled), point downward, and the tube is carefully inserted into the rectum. The piston (Fig. 775) is now applied to the end of the suppository, which is gently pushed into the rectum, the tube being then withdrawn.

Suppository Capsules.—Dr. F. E. Stewart has suggested the employment of gelatin shells with conical caps, to be used as suppositories. The medicating ingredients are inserted in the lower portion. The upper margin is then moistened with water, and the cap inserted. Before introducing them into the rectum they should be wet with sufficient water to enable them to slip in easily (see Fig. 777).

Fig. 775

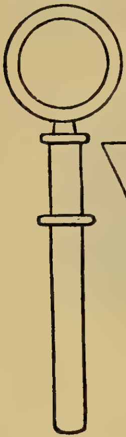
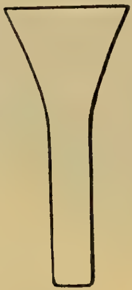
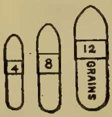


Fig. 776



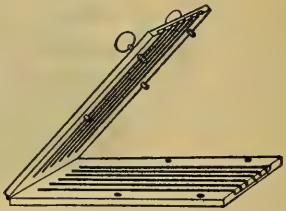
Suppositor

Fig. 777



Suppository capsules

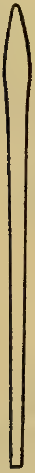
Fig. 778



Mitchell's gelatin bougie mould

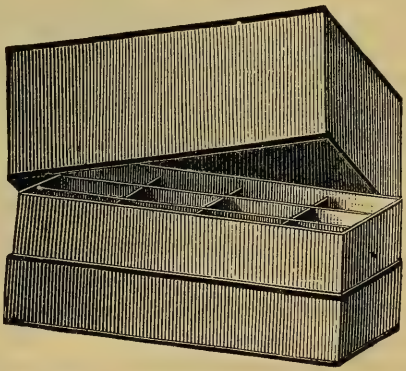
Urethral suppositories, or bougies, are preferably made of gelatin, owing to the difficulty of introducing into the urethra those made from cacao butter, on account of their brittleness. They may be made by melting together three parts of white gelatin, one part of

Fig. 779



Wellcome's urethral suppository

Fig. 780



Suppository box

glycerin, and one part of distilled water, by weight, then adding the desired medicament and drawing the mass into a glass tube of suitable size, which has been previously oiled by sucking a small quantity of oil into it and allowing it to run out. After cooling, the mass is pushed out by means of an oiled rod, and cut into pieces of suitable length. These should be rolled in lycopodium to prevent adhesion. Fig. 778 shows Mitchell's bougie mould for making them in quantity.

Henry S. Wellcome, of London, has devised an improved form of urethral suppository upon the same plan as the rectal suppository (see Fig. 779). This, from its peculiar shape, and particularly on account of the elongated bulb near the top, is less likely to be involuntarily expelled after insertion.

Dispensing Suppositories.—In order to prevent injury to the surface of suppositories in handling them with warm fingers, it is advisable to place the finger tips for a few moments upon ice until they are chilled, before placing the suppositories in the box. The latter is preferably furnished with partitions (see Fig. 780). In the absence of this special box, the suppositories should be protected by a layer of cotton or each suppository may be tightly wrapped with paraffin paper, with the end of the paper twisted. If properly applied the paper forms a temporary mould about the suppository and it cannot readily collapse, even in warm weather. When the suppository is to be used it may be held by the twisted end of paper, then dropped into ice water until thoroughly chilled, the paper removed, and the suppository inserted.

STILI DILUBILES. N. F. Paste Pencils

[**Stil. Dilub.**—Unna Pencils]

These are pencils for the direct application of medicinal agents to the skin, used in modern dermatologic practice. The medicinal agent is incorporated with paste consisting of starch, dextrin, tragacanth and sugar, with sufficient water to form a plastic mass. This is rolled into cylinders, of about 5 mm. diameter, which are cut into sections about 5 cm. long, dried on parchment paper at room temperature, and wrapped in tin-foil. The following formula serves as an example:

STILI ACIDI SALICYLICI DILUBILES. N. F. Salicylic Acid Pencil

[**Stil. Acid. Salicyl. Dilub.** Stilus Acidi Salicylici Dilubilis, N. F. III]

	Metric	Old form
Salicylic Acid, in fine powder	10 Gm.	154 gr.
Tragacanth, in fine powder	5 Gm.	77 gr.
Starch, in fine powder	30 Gm.	1 oz. av. 25½ gr.
White Dextrin, in fine powder	35 Gm.	1 oz. av. 103 gr.
Sugar, in fine powder	20 Gm.	309 gr.
Distilled Water, a sufficient quantity to make a firm plastic mass.		

One hundred grammes [old form 3 ounces av., 231 grains] of this material is sufficient to make from 40 to 45 pencils.

QUESTIONS ON SOLID EXTEMPORANEOUS PREPARATIONS

What kind of substances should not be administered in powders? (See page 1700.)
Aromatic powder—What is the Latin title? What are the ingredients? For what is it used?
Compound chalk powder—Give the Latin official name. How is it prepared? For what is it used?
Compound effervescing powder—Give the Latin official name.
Give the synonym. What are the ingredients? How may it be assayed?
Compound powder of glycyrrhiza—Give Latin official name. What is the synonym?
What are the ingredients? For what is it used medicinally? What is the dose?
Powder of ipecac and opium—Give the Latin official name.
Give the synonyms. What are its ingredients and their proportions? For what is it used medicinally? What is the dose?
Compound powder of jalap—Give the Latin official name. Give the synonym.
What are the ingredients? For what is it used medicinally?
Compound powder of rhubarb—Give the Latin official name.
What are the ingredients? By what synonym is it known? For what is it used medicinally?
Compound acetanilid powder—Give the Latin official title. Name the ingredients.
What percentage of acetanilid does it contain?
How is it made? For what is it used medicinally? Give the dose.
Powder of aloes and canella—Give the Latin title and synonym.
What are the ingredients? What are its uses? What precaution should be taken in selling it?
Antimonial powder—Give Latin title and synonym. What are its ingredients, uses, and dose?
Soluble antiseptic powder—Name the ingredients. What are its uses?
Rubefacient spice powder—Give Latin title and synonym. Name the ingredients. What are its uses?
Aromatic powder of chalk—Name the ingredients. What are its uses and dose?
Aromatic powder of chalk and opium—How much opium does it contain? Give uses and dose.
Compound powder of gambir—What is the synonym? Name the ingredients, uses and dose.
Powder of mild mercurous chloride and jalap—Give the synonym, ingredients, uses, and dose.
Compound powder of kino and opium—Name the ingredients. How much opium does it contain? What are its uses and dose?
Compound powder of bayberry—Give the Latin title and synonym. What are the ingredients, uses, and dose?
Compound pancreatin powder—Name the synonyms. What are the ingredients? How is it used?
Anisated powder of rhubarb and magnesia—What is the synonym? Name the ingredients, uses, and dose.
Compound powder of talc—What are the synonyms? Name the ingredients and uses.
Effervescent powders—What are these preparations? Name those official in the U. S. P. and N. F.
Oil sugars—What are these products? How much oil do they contain?
Give the general formula for triturations.
What trituration is official?
Give its formula. What is its medicinal value?
What color of paper should be used for wrapping packages? How should the package be wrapped?
Describe a Seidlitz powder measure. Is such a measure accurate?
Describe the covered prescription sieve.
How may powders of uniform size and weight be divided without having to weigh each powder?
How can powder papers be folded so as to present a uniform appearance?
Describe a Michael's powder divider. Weills's powder divider.
What is a cachet, or, as sometimes called, "cachet de pain"?
How are cachets used?
How is wafer-sheet prepared?
How is it used for taking powders?
How may bottles be utilized for sealing cachets?

Describe the cachet apparatus sold by J. M. Grosvenor and Co.
Describe Johann Schmidt's "Saccelli amylacei" and "dryseal" cachet apparatus.
What are tablet triturates? What diluent is usually used? How is a formula devised? Describe a machine for moulding tablet triturates. How are they made?
What are troches, and how are they used?
Describe Hahn's pestle-cap. For what purpose is it used?
How is the mass prepared for making troches?
How are troches cut?
What contrivances are used to give them uniformity?
Give the English official names of the following varieties of troches and the quantity of the medicinal ingredient contained in each:
Troches of tannic acid; ammonium chloride; cubeb; potassium chlorate; sodium bicarbonate; charcoal; gambir; peppermint; phenolphthalein; quinine; tannate; santonin; compound santonin; sulphur and potassium bitartrate; elm.
What are confections?
By what other names are these preparations known?
What is the basis of confections?
How many confections are official in the N. F.? Name them.
How is confection of rose prepared?
How is confection of senna prepared?
How many pill masses are official?
How is mass of ferrous carbonate prepared? What is its synonym?
What preparation of iron does the finished mass contain?
What chemical reaction takes place between ingredients of the mass?
How is it assayed?
Mass of mercury—Give the Latin official name. Give the synonyms.
How is it prepared? What proportion does the mercury bear to the mass?
How long should the ingredients be triturated?
Describe Day's pill mass mixer.
Describe Day's pill mass roller.
What are pills?
What are the essential requirements of a pill mass?
Give the names of some of the more ordinary excipients.
Give the formula for making a convenient, general excipient.
How may pill masses be conveniently divided into pills?
How is a pill tile used in making pills?
Describe a "pill machine."
Describe Michael's pill cutter.
Describe the Diamond pill cutter.
When should dusting powder be used in making pills? What kind of powder may be used? How may pills be "finished"?
Describe Colton's modern pill plant.
How are "friable pills" made?
How should pills be dispensed?
Name the important ingredients in the following pills, official in the U. S. Pharmacopœia; name the synonyms:
Pills of aloes; asafetida; compound cathartic; ferrous carbonate; ferrous iodide; phosphorus; compound rhubarb.
Name the important ingredients in the following N. F. pills giving the synonyms:
Dinner pills (Chapman's, Cole's, Hall's); pills of aloes and asafetida; aloes and iron; aloes and mastic; aloes and myrrh; compound aloes and podophyllum; aloes, mercury, and podophyllum; aloes, mercury, and scammony; compound aloin; aloin, strychnine, and belladonna; compound aloin, strychnine, and belladonna; antidyspeptic; compound antimony; antiperiodic; antiperiodic without aloes; vegetable cathartic; compound cathartic; colocynth and hyoscyamus; colocynth and podophyllum; digitalis, squill, and mercury; iron, quinine, aloes, and nux vomica; iron, quinine, strychnine, and arsenic (stronger) and mild; nitroglycerin; compound laxative; post partum laxative; opium, digitalis, and quinine; opium and camphor; opium and lead; rhubarb.
With what substance are pills coated?
Describe the sugar coating of pills. Chocolate coating.
Describe the earliest methods for gelatin coating. How was this improved by Allaire?
Describe Maynard's pill coater.

Describe Franciscus's pill coater.
Describe Palethorpe's pill coater.
Describe Patch's pill coater.
How is the vacuum used in pill coating?
How may pills be coated at the prescription counter with salol?
What are such pills called?
What property do they possess?
What is "pearl" coating? How may pills be coated with gold or silver?
How may pills be coated extemporaneously with sugar? With cocoa? With tolu? With stearic acid?
How are compressed pills or troches made?
What are the advantages of compressed pills?
How may punches and dies on tablet machines be adjusted?
What treatment is required by powders before they can be compressed?
What is meant by "granulating" the powder before compressing?
What substances may be compressed without special treatment?
How are the usual ingredients prepared for granulation?
What is meant by diluents? What are the most important?
Describe the use of a disintegrator.
What substances may be used for this purpose?
How is the mixture best rendered uniform?
What excipients are mostly used for the granulation? Enumerate the conditions under which you would use each kind.
How is the granulation prepared?
What substances are used as lubricants?
Why is a lubricant necessary?
Describe the best procedure for originating a formula for a number of tablets.
What are the Latin title and synonym for the one official tablet?
Describe the official requirements for this tablet. Why are these precautions taken? Why is sodium chloride added?
What varieties of gelatin capsules are made? How are they made?
How are empty capsules filled?
Describe Raymond's capsule filler.
Describe Parke, Davis Company's capsule filler.
Describe Ihrig's capsule filler.
What are "pearls" or "globules"?
Describe how these are made. What are their advantages?
How may enteric capsules be made?
What are the advantages and disadvantages of salol as a coating?
What are glutoid capsules? How may their efficiency be proven?
What are suppositories?
What is ordinarily the best base for suppositories?
How are gelatin suppositories made?
What is the usual size of suppositories?
In what different ways are suppositories made?
How are rolled suppositories made?
How are moulded suppositories made?
How are suppositories of boroglycerin made?
Give the formula for glycerinated gelatin. How is it made?
How are suppositories of glycerin made?
What varieties of moulds are used in making them?
What is the greatest objection to individual moulds?
What are the advantages of divided moulds?
What is the best form of divided mould?
Wherein do hinged moulds differ from divided moulds?
How are compressed suppositories made?
Describe Archibald's suppository machine.
Describe Whitall Tatum Company's suppository machine.
Describe the "rapid fire" suppository machine.
Describe Colton's power suppository machine.
What is a suppositor, and for what is it used?
How are capsules used for suppositories?
Of what are urethral suppositories or bougies preferably made, and why?
What are paste pencils? Give a typical formula.
How should suppositories be dispensed?

CHAPTER LXVIII

SOLID EXTEMPORANEOUS PREPARATIONS USED EXTERNALLY

Cerates, Ointments, Plasters, and Papers

Cerata *Cerates*

Cerates are unctuous substances of such consistence that they may be easily spread, at ordinary temperatures, upon muslin or similar material with a spatula, and yet not so soft as to liquefy and run when applied to the skin. They are mostly used as dressings for inflamed surfaces, and are generally made with oil, lard, or petrolatum for a basis, with sufficient wax to give the desired consistence. Owing to the presence of wax (*Cera*) they are called *Cerates.* Paraffin, spermaceti, and resin are also used to raise the melting points of oils and fats.

Cerates are made either by *fusion* or by *incorporation.* In the first method, the ingredients are melted together, and the mixture strained, to separate mechanical impurities, and stirred until cold, to render it homogeneous. By incorporation is meant the process which consists in placing the fatty ingredients upon an ointment slab or pill tile, or in a mortar, and gradually mixing in the other ingredients, with a spatula or pestle, until a uniform preparation results.

Six cerates are official.

U. S. P. Cerates

Ceratum	Made by fusing together 300 Gm. of White Wax and 700 Gm. of Benzoinated Lard, and stirring until cold
Cantharidis	Made by macerating 350 Gm. of powdered Cantharides in 150 mils of Oil of Turpentine and 25 mils of Glacial Acetic Acid in a warm place for 48 hours. Melt together 175 Gm. of Rosin, 175 Gm. of Yellow Wax, and 200 Gm. of Benzoinated Lard; add the macerated Cantharides and heat on a water bath until the mixture weighs 1000 Gm.
Resinæ	Made by fusing together 350 Gm. of Rosin, 150 Gm. of Yellow Wax, and 500 Gm. of Lard, straining and cooling

N. F. Cerates

Ceratum Camphoræ U. S. P. VIII	Made by mixing 100 Gm. of Camphor Liniment with 350 Gm. of White Wax, 150 Gm. of White Petrolatum, and 400 Gm. of Benzoinated Lard melted together
Plumbi Subacetatis U. S. P. VIII	Made by incorporating 20 Gm. of Solution of Lead Subacetate with 20 Gm. of Wool Fat and adding 38 Gm. of White Petrolatum and 20 Gm. of White Wax, melted together, and in which 2 Gm. of Camphor has been dissolved. Mix the whole thoroughly
Resinæ Compositum U. S. P. VIII	Made by fusing together 225 Gm. of Rosin, 225 Gm. of Yellow Wax, 300 Gm. of Prepared Suet, and 115 Gm. of Turpentine, adding 135 Gm. of Linseed Oil to the melted mixture; straining and then stirring until cold

Unofficial Cerate

Name	Ingredients	Preparation
Ceratum Cetacei. U. S. P. 1890	100 Gm. Spermaceti; 350 Gm. White Wax; 550 Gm. Olive Oil	Melt together the Spermaceti and White Wax; add the warmed Olive Oil, and stir until the mixture is cold

CERATUM. U. S. Cerate

[**Cerat.**—Simple Cerate]

	Metric	Old form
***White Wax**	300 Gm.	4 oz. av. 350 gr.
Benzoinated Lard	700 Gm.	11 oz. av. 88 gr.
To make	1000 Gm.	16 oz. av.

Melt the white wax by the heat of a water bath, add the benzoinated lard, continue the heat until the mixture is liquefied, strain if necessary and stir constantly until it congeals.

For use in southern latitudes and during the heated season in other localities, 50 Gm. [old form 350 grains] of the benzoinated lard (or more, if necessary) may be replaced by an equal quantity of white wax.

CERATUM CANTHARIDIS. U. S. Cantharides Cerate

[**Cerat. Canthar.**—Blistering Cerate]

	Metric	Old form
***Cantharides,** in No. 60 powder	350 Gm.	5 oz. av. 263 gr.
Glacial Acetic Acid	25 mils	182 min.
Oil of Turpentine	150 mils	2 fl. oz. 182 min.
Yellow Wax	175 Gm.	2 oz. av. 350 gr.
Rosin	175 Gm.	2 oz. av. 350 gr.
Benzoinated Lard	200 Gm.	3 oz. av. 88 gr.
To make	1000 Gm.	16 oz. av.

Moisten the cantharides with the oil of turpentine and the glacial acetic acid, previously mixed, and set the mixture aside in a well-covered container, in a warm place, for forty-eight hours. Melt together the rosin, yellow wax, and benzoinated lard; strain the mixture through muslin, add the macerated cantharides and keep the mixture in a liquid condition by heating it on a water bath with occasional stirring, until it is reduced in weight to 1000 Gm. [old form 16 ounces av.]. Then withdraw the heat and stir the Cerate until it becomes firm.

U. S. P. Preparation.—Emplastrum Cantharidis.

CERATUM RESINÆ. U. S. Rosin Cerate

[**Cerat. Res.**—Basilicon Ointment]

	Metric	Old form
***Rosin**	350 Gm.	3½ oz. av.
Yellow Wax	150 Gm.	1½ oz. av.
Lard	500 Gm.	5 oz. av.
To make	1000 Gm.	10 oz. av.

Melt the rosin, add the yellow wax and the lard, and continue the heat until liquefied, then strain the liquid through muslin, and allow it to congeal with occasional stirring.

In cold weather 530 Gm. [old form 5 ounces av., 132 grains] of lard and 120 Gm. [old form 1 ounce av., 87 grains] of yellow wax may be used.

U. S. P. Preparation.—Linimentum Terebinthinæ.

CERATUM CAMPHORÆ. N. F. **Camphor Cerate**

(U. S. P. VIII)

[Cerat. Camph.]

	Metric	Old form
Camphor Liniment	100 Gm.	1 oz. av. 262 gr.
White Wax	350 Gm.	5 oz. av. 262 gr.
White Petrolatum	150 Gm.	2 oz. av. 175 gr.
Benzoinated Lard	400 Gm.	6 oz. av. 175 gr.
To make	1000 Gm.	16 oz. av.

Melt the white wax, add the white petrolatum, then the benzoinated lard, and continue the heat until the mixture is liquefied. Add the camphor liniment and stir the mixture until it congeals.

CERATUM PLUMBI SUBACETATIS. N. F. **Cerate of Lead Subacetate**

(U. S. P. VIII)

[Cerat. Plumb. Subacet.—GOULARD'S CERATE]

	Metric	Old form
Solution of Lead Subacetate	20 Gm.	350 gr.
Wool Fat	20 Gm.	350 gr.
White Wax	20 Gm.	350 gr.
White Petrolatum	38 Gm.	1 oz. av. 227 gr.
Camphor	2 Gm.	35 gr.
To make	100 Gm.	4 oz. av.

Melt the white petrolatum and white wax in a dish on a water bath, remove the heat and dissolve the camphor in the warm mixture. Add the wool fat, mix thoroughly and then gradually incorporate the solution of lead subacetate by continuous stirring.

CERATUM RESINÆ COMPOSITUM. N. F. **Compound Rosin Cerate**

(U. S. P. VIII)

[Cerat. Resin. Co.—DESHLER'S SALVE]

	Metric	Old form
Rosin	225 Gm.	3 oz. av. 262 gr.
Yellow Wax	225 Gm.	3 oz. av. 262 gr.
Prepared Suet	300 Gm.	4 oz. av. 350 gr.
Turpentine	115 Gm.	1 oz. av. 367 gr.
Linseed Oil	135 Gm.	2 oz. av. 70 gr.
To make about	1000 Gm.	16 oz. av.

Melt the rosin, yellow wax, turpentine, and prepared suet, add the linseed oil, and continue the heat until the mixture is liquefied. Strain it through coarse muslin, stirring until it begins to congeal.

Unguenta *Ointments*

Ointments are fatty preparations, of a softer consistence than cerates, intended to be applied to the skin by inunction. The medicating ingredients are combined with a vehicle of lard, petrolatum, wool fat, or similar substance. Ointments are made in several ways: 1. By fusion. 2. By incorporation. 3. By chemical reaction.

1. **By Fusion.**—In making ointments in this way, care must be observed not to apply sufficient heat to burn the constituents. Cerates and ointments may be strained through flannel or muslin to separate mechanical impurities, or some may be filtered. (See page 239.)

2. **By Incorporation.**—The method of making ointments by incorporation is more frequently used than any other. The medicating ingredients used are nearly always insoluble in the basis, and it is necessary, therefore, to reduce them to a fine state of division in order

to facilitate their absorption or medicinal action. The usual mode of procedure is to place the fatty basis upon an ointment slab, and the medicating substance close by. The latter, if in fine powder, is first mixed with a *small portion* of the basis by rubbing both backward and forward with the blade of a spatula until the mixture is perfectly smooth. It is then a very simple operation to dilute this small quantity of concentrated ointment by incorporating it with the rest of the basis, by using the spatula in the same way. If extracts are to be incorporated, they are softened by adding a little water or diluted alcohol, until a smooth paste is made, which is then mixed with the basis with a spatula. An excellent ointment slab is made by setting a plate of ground glass in a wooden frame or slide (see page 1071).

Fig. 781

Paper ointment block

Fig. 782

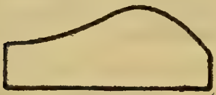
Spatula (all horn)

Ointments are sometimes made in a mortar with the pestle; but this mode is less convenient.

Fig. 781 shows the ointment block, consisting of a "paper pad," furnished by Fox, Fultz & Co. The soiled sheet may be discarded and the cleaning of an ointment slab thus avoided.

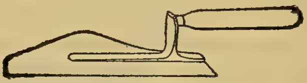
In incorporating ointments containing substances which act on steel, horn or rubber spatulas may be used (see Figs. 135, 137 and 782). When large quantities of ointments are required to be made by incorporation, as is sometimes the case in hospitals, dispensaries, etc., an ointment trowel may be made by cutting a mason's trowel into the shape shown in Figs. 783 and 784,—the former giving the bottom view, the latter the side view. This affords a large working surface, and the incorporation can be performed quickly.

Fig. 783



Ointment trowel (bottom view)

Fig. 784



Ointment trowel (side view)

3. **By Chemical Reaction.**—The only official ointment that is made by chemical reaction is the ointment of mercuric nitrate. In this, the olein of the lard is converted into elaidin through the action of heat and nitric acid; solution of mercuric nitrate is then incorporated with the elaidin vehicle.

Maxims to be observed in making or dispensing Ointments.—1. They should never be dispensed if they have the slightest taint of rancidity. 2. They should always be smooth and free from grittiness or irritating particles. 3. Ointments containing free acid, iodine, or tannin should not be rubbed with an iron or steel spatula, on account of the chemical action on the metal.

U. S. P. Ointments made by Fusion

Unguentum	Made by fusing together 200 Gm. of White Wax and 800 Gm. of Benzoinated Lard, and stirring until cold
Acidi Borici	Made by fusing together 50 Gm. of Paraffin and 850 Gm. of White Petrolatum, incorporating 100 Gm. of powdered Boric Acid, and stirring until cold
Aquæ Rosæ	Made by fusing together at a moderate heat 560 Gm. of Expressed Oil of Almond, 125 Gm. of Spermaceti, and 120 Gm. of White Wax, gradually adding 190 Gm. of Stronger Rose Water, in which 5 Gm. of Sodium Borate has been dissolved, and stirring until a uniformly soft and creamy mixture is obtained
Chrysarobini	Made by incorporating 6 Gm. of Chrysarobin in 94 Gm. of melted Benzoinated Lard, heating gently during twenty minutes, and then stirring until cold
Diachylon	Made by fusing 50 Gm. of Lead Plaster with 49 Gm. of White Petrolatum, allowing the mass to partly cool, and then adding 1 Gm. of Oil of Lavender and stirring until cold
Hydrargyri	Made by mixing 500 Gm. of Mercury with 20 Gm. of Oleate of Mercury, then adding, in portions, 250 Gm. of Benzoinated Lard, and 230 Gm. of Prepared Suet, previously melted together and partially cooled and continuing the trituration until globules of mercury cease to be visible under a magnifying power of 10 diameters
Hydrargyri Ammoniati	Made by incorporating 10 Gm. of powdered Ammoniated Mercury with 50 Gm. of melted White Petrolatum, adding 40 Gm. of melted Hydrous Wool Fat, and stirring until cold
Phenolis	Made by adding 2.25 Gm. of Liquefied Phenol to 97.75 Gm. of melted Ointment and stirring the mixture until cold
Picis Liquidæ	Made by fusing at a moderate heat 350 Gm. of Lard and 150 Gm. of Yellow Wax, then adding 500 Gm. of Tar, straining, and stirring constantly until cold
Zinci Oxidi	Made by incorporating 200 Gm. of powdered Zinc Oxide with 800 Gm. of melted Benzoinated Lard, and stirring the mixture until cold

U. S. P. Ointments made by Incorporation without Heat

Unguentum Acidi Tannici	Made by dissolving 20 Gm. of Tannic Acid in 20 Gm. of Glycerin, and incorporating the solution with 60 Gm. of Ointment
Belladonnæ	Made by rubbing 10 Gm. of Pilular Extract of Belladonnæ Leaves with 5 mils Diluted Alcohol until soft, then incorporating the mixture thoroughly with 30 Gm. of Hydrous Wool Fat and 55 Gm. of Benzoinated Lard
Gallæ	Made by incorporating 20 Gm. of powdered Nutgall with 80 Gm. of Ointment
Hydrargyri Dilutum	Made by uniformly mixing 600 Gm. of Mercurial Ointment with 400 Gm. of Petrolatum
Hydrargyri Oxidi Flavi	Made by triturating 10 Gm. of Yellow Mercuric Oxide with 10 Gm. of Water, and thoroughly incorporating the mixture with 40 Gm. of Hydrous Wool Fat and 40 Gm. of Petrolatum
Iodi	Made by triturating 4 Gm. of Iodine and 4 Gm. of Potassium Iodide with 12 Gm. of Glycerin until dissolved, and thoroughly mixing the solution with 80 Gm. of Benzoinated Lard, avoiding the use of metallic utensils
Iodoformi	Made by thoroughly incorporating 10 Gm. of Iodoform with 90 Gm. of Lard
Stramonii	Made by rubbing 10 Gm. of Pilular Extract of Stramonium with 5 mils of Diluted Alcohol until soft, then incorporating the mixture thoroughly with 20 Gm. of Hydrous Wool Fat and 65 Gm. of Benzoinated Lard
Sulphuris	Made by thoroughly incorporating 150 Gm. of Sublimed Sulphur with 850 Gm. of Benzoinated Lard

U. S. P. Ointment made by Chemical Reaction

Unguentum Hydrargyri Nitratis	See page 1808

N. F. Ointments made by Fusion

Unguentum Camphoræ	Made by dissolving 22 Gm. of Camphor in 11 Gm. of melted White Wax and 67 Gm. of melted Lard and stirring the mixture until cold
Fuscum	Made by melting together 50 Gm. of Camphorated Brown Plaster, 25 Gm. of Olive Oil and 25 Gm. of Prepared Suet and stirring until cold
Picis Compositum	Made by melting 25 Gm. of Yellow Wax, 32 Gm. of Lard and 34 Gm. of Cottonseed Oil together, then adding 2 Gm. of Tincture of Benzoin, withdrawing the heat, adding 4 Gm. of Rectified Oil of Tar, then 3 Gm. of Zinc Oxide and incorporating the mixture so that a smooth ointment results.
Resorcinolis Compositum	Made by melting 10 Gm. of Yellow Wax and 28 Gm. of Wool Fat on a water bath, incorporating 6 Gm. of Zinc Oxide, and 6 Gm. of Bismuth Subnitrate with 25 Gm. of Petrolatum, adding it to the melted mixture and then incorporating 6 Gm. of Resorcinol, dissolved in 13 Gm. of Glycerin, and lastly adding 6 Gm. of Rectified Oil of Birch Tar

N. F. Ointments made by Incorporation without Heat

Unguentum Calaminæ	Made by uniformly mixing 17 Gm. of Prepared Calamine with 83 Gm. of Ointment
Hydrargyri Oxidi Rubri (U. S. P. VIII)	Made by triturating 10 Gm. of Red Mercuric Oxide with 10 mils of Water, and thoroughly incorporating the mixture with 40 Gm. of Hydrous Wool Fat and 40 Gm. of Petrolatum
Plumbi Iodidi	Made by uniformly mixing 10 Gm. of Lead Iodide and 90 Gm. of Benzoinated Lard
Potassii Iodidi (U. S. P. VIII)	Made by dissolving 10 Gm. of Potassium Iodide and 1 Gm. of Sodium Thiosulphate in 9 Gm. of Water and mixing this with 80 Gm. of Benzoinated Lard
Sulphuris Alkalinum	Made by rubbing 20 Gm. of Sublimed Sulphur and 10 Gm. of Potassium Carbonate with 5 mils of Water until a smooth mixture results, then gradually incorporating 65 Gm. of Benzoinated Lard
Sulphuris Compositum	Made by mixing 30 Gm. of Lard, 30 Gm. of Soft Soap and 15 Gm. of Oil of Cade and then adding 15 Gm. of Sublimed Sulphur and 10 Gm. of Precipitated Calcium Carbonate
Veratrinæ (U. S. P. VIII)	Made by mixing 4 Gm. of Veratrine with 6 Gm. of Expressed Oil of Almond and gradually adding 90 Gm. of Benzoinated Lard
Zinci Stearatis (U. S. P. VIII)	Made by rubbing 50 Gm. of Zinc Stearate with 50 Gm. of White Petrolatum

Unofficial Ointments

Name	Ingredients	Preparation
Unguentum Acidi Salicylici. Br.	2 Gm. Salicylic Acid; 98 Gm. Paraffin Ointment	Mix them
Aconitinæ. Br.	2 Gm. Aconitine; 16 Gm. Oleic Acid; 82 Gm. Lard	Dissolve the Aconitine in the Oleic Acid, with the aid of a gentle heat, and mix the solution with the Lard
Atropinæ. Br.	2 Gm. Atropine; 8 Gm. Oleic Acid; 90 Gm. Lard	Dissolve the Atropine in the Oleic Acid, with the aid of a gentle heat, and mix the solution with the Lard
Cantharidini. Br.	0.1 Gm. Cantharidin; 10 mils Chloroform; 290 Gm. Benzoinated Lard	Dissolve the Cantharidin in the Chloroform; add the solution to the melted Benzoinated Lard, stir until cool
Capsici. Br.	25 Gm. Capsicum Fruit, bruised; 10 Gm. Hard Paraffin; 75 Gm. Soft Paraffin; 10 Gm. Prepared Lard	Digest on a water bath, occasionally stirring, strain, and cool without stirring
Cetacei. Br.	20 Gm. Spermaceti; 8 Gm. White Beeswax; 72 Gm. Liquid Paraffin	Melt together, stir until cold
Chaulmoogræ. Br.	10 Gm. Chaulmoogra Oil; 40 Gm. Hard Paraffin; 50 Gm. Soft Paraffin	Melt the Paraffins together, add the Chaulmoogra Oil; stir until cool
Cocainæ. Br.	4 Gm. Cocaine; 16 Gm. Oleic Acid; 80 Gm. Prepared Lard	Dissolve the Cocaine in the Oleic Acid, with the aid of a gentle heat, and mix the solution with the Lard
Conii Br. 1898	88 mils Juice of Conium; 33 Gm. Hydrous Wool Fat	Evaporate the Juice of Conium to one-eighth its volume, at a temperature not exceeding 60° C. (140° F.), and incorporate it with the Hydrous Wool Fat
Creosoti. Br.	10 Gm. Creosote; 40 Gm. Hard Paraffin; 50 Gm. Soft Paraffin, White	Melt the Hard and Soft Paraffins together, add the Cresote, and stir until cold
Eucalypti. Br.	10 Gm. Oil of Eucalyptus; 40 Gm. Hard Paraffin; 50 Gm. Soft Paraffin, White	Melt the Hard and Soft Paraffins together, add the Oil of Eucalyptus, and stir until cold
Gallæ cum Opio. Br.	92.5 Gm. Gall Ointment: 7.5 Gm. Opium, in powder	Thoroughly mix
Glycerini Plumbi Subacetatis Br. 1898	30 Gm. Glycerin of Lead Subacetate; 150 Gm. Paraffin Ointment	Mix them
Hamamelidis. Br.	10 mils Liquid Extract of Hamamelis; 60 Gm. Wool Fat; 30 Gm. Soft Paraffin	Mix them
Hydrargyri Compositum. Br.	40 Gm. Mercury Ointment; 24 Gm. Yellow Beeswax; 24 Gm. Olive Oil; 12 Gm. Camphor, powdered	Mix the Beeswax, Olive Oil, and Mercury Ointment with the aid of heat, add the Camphor, and triturate until cold
Hydrargyri Iodidi Rubri. Br.	4 Gm. Mercuric Iodide; 96 Gm. Benzoinated Lard	Mix them
Hydrargyri Nitratis Dilutum. Br.	20 Gm. Mercuric Nitrate Ointment; 80 Gm. Soft Paraffin	Mix them
Hydrargyri Oleatis. Br.	25 Gm. Mercuric Oleate; 75 Gm. Benzoinated Lard	Mix them

Unofficial Ointments—*Continued*

Name	Ingredients	Preparation
Unguentum Hydrargyri Subchloridi. Br.	20 Gm. Mercurous Chloride; 80 Gm. Benzoinated Lard	Mix them
Lanæ Compositum. Br.	40 Gm. Prepared Lard; 40 Gm. Wool Fat; 20 Gm. Paraffin Ointment	Melt together; stir until cool
Myrobalani. Br.	20 Gm. Myrobalans; 80 Gm. Benzoinated Lard	Mix by trituration until a smooth mixture results
Myrobalani cum Opio. Br.	92.5 Gm. Myrobalani Ointment; 7.5 Gm. Powdered Opium	Mix by triturating the Opium with the Myrobalan Ointment until a smooth mixture results
Paraffini. Br.	27 Gm. Hard Paraffin; 70 Gm. Soft Paraffin; 3 Gm. White Beeswax	Melt them together and stir constantly during the cooling. (White Soft Paraffin may replace the Yellow if desired)
Plumbi Subacetatis. Br.	12.5 Gm. Strong Solution Lead Subacetate; 25 Gm. Wool Fat; 12.5 Gm. Hard Paraffin; 50 Gm. Soft Paraffin	Melt the Wool Fat and Hard and Soft Paraffins; cool, add the Solution of Lead Subacetate, and continue to stir until cold
Plumbi Carbonatis. U. S. P. 1890	10 Gm. Lead Carbonate; 90 Gm. Benzoinated Lard	Incorporate the finely powdered Lead Carbonate with the Benzoinated Lard
Resinæ. Br.	26 Gm. Resin; 26 Gm. Yellow Beeswax; 26 Gm. Olive Oil; 22 Gm. Prepared Lard	Melt together; strain; stir until cold
Unguentum Staphisagriæ. Br.	20 Gm. Stavesacre Seeds; 10 Gm. Yellow Beeswax; 85 Gm. Benzoinated Lard	Digest the crushed Seeds in the melted Lard, on a water bath, during two hours, strain, add the beeswax, heat until uniform, and stir during cooling
Sulphuris Iodidi Br. 1898	2 Gm. Sulphur Iodide; 2 Gm. Glycerin; 46 Gm. Benzoinated Lard	Triturate the Sulphur Iodide and Glycerin to a smooth paste, and incorporate it with the Benzoinated Lard
Zinci Oleatis. Br.	30 Gm. Zinc Sulphate; 90 Gm. Hard Soap; Distilled Water; Soft Paraffin, white, of each a sufficient quantity	Dissolve the Zinc Sulphate in 60 mils of Distilled Water; and the Soap in 600 mils of Distilled Water. Mix the solutions; heat to boiling; allow the melted Zinc Oleate thus formed to rise to the surface; cool, pour off the aqueous solution and boil the Zinc Oleate with successive portions of Distilled Water. Then reduce the product to a fine powder and mix with an equal weight of melted white Soft Paraffin

UNGUENTUM. U. S. Ointment

[Ung.—Simple Ointment]

	Metric	Old form
***White Wax**	**200 Gm.**	1 oz. av.
Benzoinated Lard	**800 Gm.**	4 oz. av.
To make	**1000 Gm.**	5 oz. av.

Melt the white wax, add the benzoinated lard, and heat gently until liquefied; then stir the mixture until it congeals. For use in southern latitudes and during the warm season in other localities, 50 Gm. [old form 109 grains] of the benzoinated lard (or more, if necessary) may be replaced by an equal quantity of white wax.

U. S. P. Preparation.—Unguentum Acidi Tannici; Unguentum Gallæ; Unguentum Phenolis.

N. F. Preparation.—Unguentum Calaminæ.

UNGUENTUM ACIDI BORICI. U. S. **Ointment of Boric Acid**

[Ung. Acid. Bor.]

	Metric.	Old form
***Boric Acid,** in fine powder	100 Gm.	44 gr.
Paraffin	50 Gm.	22 gr.
White Petrolatum	850 Gm.	372 gr.
To make about	1000 Gm.	1 oz. av.

Melt the paraffin, add the white petrolatum, and heat gently until liquefied. Then gradually add the hot liquid to the boric acid, contained in a warm mortar, triturating thoroughly, and stir the mixture until it congeals.

UNGUENTUM ACIDI TANNICI. U. S. **Ointment of Tannic Acid**

[Ung. Acid. Tann.]

	Metric	Old form
***Tannic Acid**	20 Gm.	88 gr.
Glycerin	20 Gm.	88 gr.
Ointment	60 Gm.	262 gr.
To make	100 Gm.	1 oz. av.

Dissolve the tannic acid in the glycerin with the aid of a gentle heat, and mix the solution thoroughly with the ointment, avoiding the use of iron utensils.

UNGUENTUM AQUÆ ROSÆ. U. S. **Ointment of Rose Water**

[Ung. Aq. Ros.]

	Metric	Old form
***Spermaceti**	125 Gm.	2 oz. av.
White Wax	120 Gm.	1 oz. av. 403 gr.
Expressed Oil of Almond	560 Gm.	8 oz. av. 420 gr.
Sodium Borate, in fine powder	5 Gm.	35 gr.
Stronger Rose Water	190 Gm.	3 oz. av. 17 gr.
To make about	1000 Gm.	16 oz. av.

Reduce the spermaceti and the white wax to fine pieces and melt them on a water bath, add the expressed oil of almond and stir, continuing the heat until the mixture is uniform. Dissolve the sodium borate in the stronger rose water warmed on a water bath to the temperature of the melted wax and fat, and add the warm solution gradually to the melted mixture, stirring it rapidly and continuously until it congeals and becomes of uniform consistence.

Ointment of Rose Water must be free from rancidity. If the Ointment has been chilled, warm it slightly before attempting to incorporate other ingredients with it.

UNGUENTUM BELLADONNÆ. U. S. **Belladonna Ointment**

[Ung. Bellad.]

	Metric	Old form
***Pilular Extract of Belladonna Leaves**	10 Gm.	44 gr.
Diluted Alcohol	5 mils	½ fl. dr.
Hydrous Wool Fat	30 Gm.	131 gr.
Benzoinated Lard	55 Gm.	241 gr.
To make about	100 Gm.	about 1 oz. av.

Triturate the extract with the diluted alcohol until a smooth mixture is obtained; with this incorporate the hydrous wool fat; then add the benzoinated lard and mix thoroughly.

UNGUENTUM CHRYSAROBINI. U. S. Chrysarobin Ointment
[Ung. Chrysarobin.]

	Metric	Old form
***Chrysarobin**	6 Gm.	26 gr.
Benzoinated Lard	94 Gm.	412 gr.
To make	100 Gm.	1 oz. av.

Triturate the chrysarobin with the benzoinated lard previously melted, and heat the mixture on a water bath for twenty minutes, with occasional stirring; then strain and stir until it congeals.

UNGUENTUM DIACHYLON. U. S. Diachylon Ointment
[Ung. Diachyl.]

	Metric	Old form
***Lead Plaster**	50 Gm.	219 gr.
Oil of Lavender	1 Gm.	5 min.
White Petrolatum	49 Gm.	214 gr.
To make about	100 Gm.	about 1 oz. av.

Melt together the lead plaster and the white petrolatum by applying a gentle heat, strain the mixture, allow it to cool but not congeal, add the oil of lavender, and stir the Ointment until it is cold.

UNGUENTUM GALLÆ. U. S. Nutgall Ointment
[Ung. Gall.]

	Metric	Old form
***Nutgall, in very fine powder**	20 Gm.	88 gr.
Ointment	80 Gm.	350 gr.
To make	100 Gm.	1 oz. av.

Rub the nutgall with the ointment, gradually added, until they are thoroughly mixed. Avoid the use of metallic utensils.

UNGUENTUM HYDRARGYRI. U. S. Mercurial Ointment
[Ung. Hydrarg.]

	Metric	Old form
***Mercury**	500 Gm.	1 oz. av.
Oleate of Mercury	20 Gm	18 gr.
Prepared Suet	230 Gm.	201 gr.
Benzoinated Lard	250 Gm.	220 gr.
To make	1000 Gm	2 oz. av.

Triturate the oleate of mercury in a warm mortar, with the mercury added gradually, and when the globules are completely divided and distributed, set it aside for about fifteen minutes. Melt the lard and suet, allow the mixture to partially cool, add about 25 Gm. [old form 22 grains] of it to the mercurial mixture, and continue the trituration until globules of mercury are no longer visible under a lens magnifying ten diameters. Then add the remainder of the lard and suet and mix thoroughly.

Assay.—Weigh 10 Gm. of Mercurial Ointment in a tared dish, melt it, then remove it from the fire and add 50 mils of warm purified petroleum benzin. Stir the mixture well, allow the mercury to settle completely, and decant the benzin. Wash the residue with successive portions of 10 mils each of warm purified petroleum benzin until it is entirely free from fatty matter, carefully retaining all of the separated Mercury in the dish, and allowing all traces of the benzin to evaporate. Add to the residue 10 mils of diluted hydrochloric acid, heat it gently and stir with a glass rod until the mercury collects in a globule. Pour off the acid, warm the mercury with a little distilled water, dry the globule on bibulous paper, and weigh. The separated mercury weighs not less than 4.9 Gm. nor more than 5.1 Gm.

U. S. P. Preparation.—Unguentam Hydrargyri Dilutum.

UNGUENTUM HYDRARGYRI AMMONIATI. U. S. Ointment of Ammoniated Mercury

[**Ung. Hydrarg. Ammon.**—WHITE PRECIPITATE OINTMENT]

	Metric	Old form
***Ammoniated Mercury**, in very fine powder	10 Gm.	44 gr.
White Petrolatum	50 Gm.	220 gr.
Hydrous Wool Fat	40 Gm.	175 gr.
To make	100 Gm.	1 oz. av.

Rub the ammoniated mercury with an equal weight of the melted white petrolatum, then add the remainder of the melted white petrolatum, mix thoroughly with the hydrous wool fat, and stir the mixture until it congeals.

UNGUENTUM HYDRARGYRI DILUTUM. U. S. Diluted Mercurial Ointment

[**Ung. Hydrarg. Dil.**—BLUE OINTMENT HYDRARGYRI UNGUENTUM P.I.]

	Metric	Old form
***Mercurial Ointment**	600 Gm.	263 gr.
Petrolatum	400 Gm.	175 gr.
To make	1000 Gm.	1 oz. av.

Mix them thoroughly. For use in southern latitudes or during the warm season in other localities, 50 Gm. of the petrolatum (or more, if necessary) may be replaced by an equal quantity of yellow wax.

Assay.—Proceed as directed in the assay under *Unguentum Hydrargyri*. The separated mercury weighs not less than 2.9 Gm. nor more than 3.1 Gm.

UNGUENTUM HYDRARGYRI NITRATIS. U. S. Ointment of Mercuric Nitrate

[**Ung. Hydrarg. Nit.**—CITRINE OINTMENT]

	Metric	Old form
***Mercury**	7.0 Gm.	30 gr.
Nitric Acid	17.5 Gm.	55 min.
Lard, free from water	76.0 Gm.	333 gr.
To make about	100 Gm.	1 oz. av.

Warm the lard in a capacious porcelain dish until it has just melted, or to about 45° C. (113° F.). Add 7 Gm. [old form 22 minims] of the nitric acid all at once and continue the heat until the characteristic reaction is complete. Hold an inverted glass funnel over the dish to protect the operator from any lard spurting from the dish during the reaction. Withdraw the heat immediately after the rapid rise of froth which accompanies the end reaction and cool the treated lard, stirring it until it assumes a bright citrine color. Dissolve the mercury in the remainder of the nitric acid, warming it if necessary to prevent crystallizing, and mix the solution with the previously prepared lard. All contact with metallic utensils or containers must be avoided.

UNGUENTUM HYDRARGYRI OXIDI FLAVI. U. S. Ointment of Yellow Mercuric Oxide

[Ung. Hydrarg. Oxid. Flav.]

	Metric	Old form
***Yellow Mercuric Oxide**, in very fine powder	10 Gm.	44 gr.
Water	10 Gm.	46 min.
Hydrous Wool Fat	40 Gm.	175 gr.
Petrolatum	40 Gm.	175 gr.
To make	100 Gm.	1 oz. av.

Triturate the yellow mercuric oxide with the water until the mixture is perfectly smooth, then add the hydrous wool fat in divided portions, and incorporate thoroughly with the petrolatum. All contact with metallic utensils or containers must be avoided.

UNGUENTUM IODI. U. S. Iodine Ointment

[Ung. Iodi]

	Metric	Old form
***Iodine**	4 Gm.	17½ gr.
Potassium Iodide	4 Gm.	17½ gr.
Glycerin	12 Gm.	53 gr.
Benzoinated Lard	80 Gm.	350 gr.
To make	100 Gm.	1 oz. av.

Triturate the iodine and potassium iodide in a glass mortar with the glycerin until dissolved, then gradually incorporate the benzoinated lard and mix thoroughly. All contact with metallic utensils or containers must be avoided. This Ointment must not be dispensed unless it has been recently prepared.

UNGUENTUM IODOFORMI. U. S. Iodoform Ointment

[Ung. Iodof.]

	Metric	Old form
***Iodoform**, in very fine powder	10 Gm.	44 gr.
Benzoinated Lard	90 Gm.	394 gr.
To make	100 Gm.	1 oz. av.

Triturate the iodoform thoroughly with about twice its weight of the benzoinated lard, then incorporate the remainder of the benzoinated lard.

UNGUENTUM PHENOLIS. U. S. **Ointment of Phenol**
[Ung. Phenol.—OINTMENT OF CARBOLIC ACID]

	Metric	Old form
***Liquefied Phenol**	2.25 Gm.	10 gr.
Ointment	97.75 Gm.	428 gr.
To make	100 Gm.	1 oz. av.

Add the liquefied phenol to the melted ointment and stir the mixture until it begins to congeal.

UNGUENTUM PICIS LIQUIDÆ. U. S. **Tar Ointment**
[Ung. Pic. Liq.]

	Metric	Old form
***Tar**	500 Gm.	218 gr.
Yellow Wax	150 Gm.	66 gr.
Lard	350 Gm.	153 gr.
To make	1000 Gm.	1 oz. av.

Melt the yellow wax, add the lard, and to the melted mixture add the tar, previously warmed, and incorporate thoroughly; strain through muslin, and stir the mixture until it congeals.

UNGUENTUM STRAMONII. U. S. **Stramonium Ointment**
[Ung. Stramon.]

	Metric	Old form
***Pilular Extract of Stramonium**	10 Gm.	44 gr.
Diluted Alcohol	5 mils	½ fl. dr.
Hydrous Wool Fat	20 Gm.	88 gr.
Benzoinated Lard	65 Gm.	285 gr.
To make about	100 Gm.	1 oz. av.

Triturate the extract with the diluted alcohol until a smooth mixture is obtained; with this incorporate the hydrous wool fat, then add the benzoinated lard, and mix thoroughly.

UNGUENTUM SULPHURIS. U. S. **Sulphur Ointment**
[Ung. Sulphur.]

	Metric	Old form
***Sublimed Sulphur**	150 Gm.	66 gr.
Benzoinated Lard	850 Gm.	372 gr.
To make	1000 Gm.	1 oz. av.

Rub the sublimed sulphur with the benzoinated lard, gradually added, until they are thoroughly mixed.

UNGUENTUM ZINCI OXIDI. U. S. **Ointment of Zinc Oxide**

[**Ung. Zinc. Ox.**—ZINC OINTMENT]

	Metric	Old form
***Zinc Oxide**, in very fine powder	200 Gm.	88 gr.
Benzoinated Lard	800 Gm.	350 gr.
To make	1000 Gm.	1 oz. av.

Rub the zinc oxide, which must be free from gritty particles, with about one-fourth of the melted benzoinated lard, in a previously warmed container, and with this incorporate the remainder of the benzoinated lard, previously melted. If necessary, strain the Ointment while warm, and stir it thoroughly until it congeals.

UNGUENTUM CALAMINÆ. N. F. **Calamine Ointment**

[**Ung. Calamin.**—UNGUENTUM ZINCI CARBONATIS CRUDI UNGUENTUM CALAMINARE TURNER'S CERATE]

	Metric	Old form
Prepared Calamine	17 Gm.	297 gr.
Ointment	83 Gm.	3 oz. av. 140 gr.
To make	100 Gm.	4 oz. av.

Mix the prepared calamine intimately with the ointment, by trituration, so as to produce a smooth and homogeneous product.

UNGUENTUM CAMPHORÆ. N. F. **Camphor Ointment**

[**Ung. Camph.**]

	Metric	Old form
Camphor, in coarse powder	22 Gm.	385 gr.
White Wax	11 Gm.	192 gr.
Lard	67 Gm.	2 oz. av. 297 gr.
To make	100 Gm.	4 oz. av.

Melt the white wax and lard with a gentle heat, then dissolve the camphor in the melted mixture without further heating and stir the ointment until it is cold.

UNGUENTUM FUSCUM. N. F. **Brown Ointment**

[**Ung. Fusc.**—UNGUENTUM MATRIS MOTHER'S SALVE]

	Metric	Old form
Camphorated Brown Plaster	50 Gm.	2 oz. av.
Olive Oil	25 Gm.	1 oz. av.
Prepared Suet	25 Gm.	1 oz. av.
To make	100 Gm.	4 oz. av

Melt together the several ingredients and stir the ointment until it is cold.

UNGUENTUM HYDRARGYRI OXIDI RUBRI. N. F. Ointment of Red Mercuric Oxide (U.S.P. VIII)

[Ung. Hydrarg. Oxid. Rub.]

	Metric	Old form
Red Mercuric Oxide, in very fine powder	10 Gm.	175 gr.
Water	10 mils	175 min.
Hydrous Wool Fat	40 Gm.	1 oz. av. 262 gr.
Petrolatum	40 Gm.	1 oz. av. 262 gr.
To make	100 Gm.	4 oz. av.

Triturate the red mercuric oxide with the water until the mixture is smooth and absolutely free from gritty particles, then add the hydrous wool fat in divided portions, and incorporate thoroughly with the petrolatum. *Contact with metallic utensils should be avoided.*

UNGUENTUM PICIS COMPOSITUM. N. F. Compound Tar Ointment

[Ung. Pic. Co.]

	Metric	Old form
Rectified Oil of Tar	4 Gm.	70 gr.
Tincture of Benzoin	2 Gm.	35 gr.
Zinc Oxide	3 Gm.	52 gr.
Yellow Wax	25 Gm.	1 oz. av.
Lard	32 Gm.	1 oz. av. 122 gr.
Cottonseed Oil	34 Gm.	1 oz. av. 158 gr.
To make	100 Gm.	4 oz. av.

Melt the yellow wax and lard with the cottonseed oil at a gentle heat, and add the tincture of benzoin. Then withdraw the heat, add the rectified oil of tar, and finally the zinc oxide, and incorporate the latter thoroughly, so that, on cooling, a smooth, homogeneous ointment results.

UNGUENTUM PLUMBI IODIDI. N. F. Ointment of Lead Iodide

[Ung. Plumb. Iod.]

	Metric	Old form
Lead Iodide, in very fine powder	10 Gm.	175 gr.
Benzoinated Lard	90 Gm.	3 oz. av. 262 gr.
To make	100 Gm.	4 oz. av.

Rub the lead iodide with the benzoinated lard gradually added, until they are thoroughly mixed.

UNGUENTUM POTASSII IODIDI. N. F. Ointment of Potassium Iodide (Replacing U. S. P. VIII)

[Ung. Pot. Iod.]

	Metric	Old form
Potassium Iodide	10 Gm.	175 gr.
Sodium Thiosulphate	1 Gm.	17 gr.
Water	9 Gm.	157 gr.
Benzoinated Lard	80 Gm.	3 oz. av. 87 gr.
To make	100 Gm.	4 oz. av.

Dissolve the potassium iodide and sodium thiosulphate in the water, then add the benzoinated lard and incorporate thoroughly. This ointment should not be dispensed unless it has been freshly prepared.

UNGUENTUM RESORCINOLIS COMPOSITUM. N. F. Compound Resorcinol Ointment

[**Ung. Resorcin. Co.**—Unguentum Resorcini Compositum, N. F. III]

	Metric	Old form
Resorcinol	**6 Gm.**	105 gr.
Zinc Oxide	**6 Gm.**	105 gr.
Bismuth Subnitrate	**6 Gm.**	105 gr.
Rectified Oil of Birch Tar	**6 Gm.**	105 gr.
Yellow Wax	**10 Gm.**	175 gr.
Petrolatum	**25 Gm.**	1 oz. av.
Anhydrous Wool Fat	**28 Gm.**	1 oz. av. 52 gr.
Glycerin	**13 Gm.**	227 gr.
To make	**100 Gm.**	4 oz. av.

Melt the yellow wax and anhydrous wool fat in a dish on a water bath. Rub the zinc oxide and bismuth subnitrate with the petrolatum until smooth and add it to the melted mixture. Dissolve the resorcinol in the glycerin, incorporate the solution with the warm mixture just prepared, then add the oil and stir the ointment until it is cold.

UNGUENTUM SULPHURIS ALKALINUM. N. F. Alkaline Sulphur Ointment

[Ung. Sulphur. Alk.]

	Metric	Old form
Sublimed Sulphur	**20 Gm.**	350 gr.
Potassium Carbonate	**10 Gm.**	175 gr.
Water	**5 mils**	87 gr.
Benzoinated Lard	**65 Gm.**	2 oz. av. 262 gr.
To make	**100 Gm.**	4 oz. av.

Rub the sulphur with the potassium carbonate and the water, until a smooth, homogeneous mixture results, then gradually add the benzoinated lard, and mix thoroughly.

UNGUENTUM SULPHURIS COMPOSITUM. N. F. Compound Sulphur Ointment

[**Ung. Sulphur. Co.**—Wilkinson's Ointment Hebra's Itch Ointment]

	Metric	Old form
Precipitated Calcium Carbonate	**10 Gm.**	175 gr.
Sublimed Sulphur	**15 Gm.**	262 gr.
Oil of Cade	**15 Gm.**	262 gr.
Soft Soap	**30 Gm.**	1 oz. av. 87 gr.
Lard	**30 Gm.**	1 oz. av. 87 gr.
To make	**100 Gm.**	4 oz. av.

Mix the lard with the soft soap and oil of cade, then gradually incorporate the sublimed sulphur and precipitated calcium carbonate and rub the ointment until it is smooth.

UNGUENTUM VERATRINÆ. N. F. Veratrine Ointment

(U. S. P. VIII)

[Ung. Veratrin.]

	Metric	Old form
Veratrine	4 Gm.	70 gr.
Expressed Oil of Almond	6 Gm.	105 gr.
Benzoinated Lard	90 Gm.	3 oz. av. 262 gr.
To make	100 Gm.	4 oz. av.

Rub the veratrine with the expressed oil of almond, then gradually add the benzoinated lard, and mix thoroughly.

UNGUENTUM ZINCI STEARATIS. N. F. Ointment of Zinc Stearate

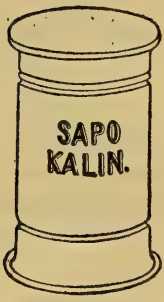
(U. S. P. VIII)

[Ung. Zinc. Stear.]

	Metric	Old form
Zinc Stearate, in fine powder	50 Gm.	2 oz. av.
White Petrolatum	50 Gm.	2 oz. av.
To make	100 Gm.	4 oz. av.

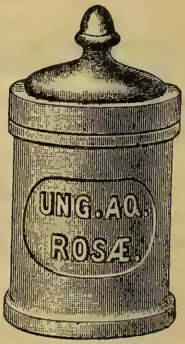
Rub the zinc stearate with the white petrolatum until a smooth ointment is produced.

Fig. 785



Porcelain jar

Fig. 786

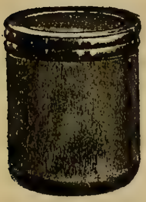


Ointment jar (amber glass)

Preserving and Dispensing Cerates and Ointments.—As has been already stated, fatty substances may be preserved from rancidity by digesting them with balsamic resins, poplar buds, styrax, etc. To preserve them during hot weather, they require in addition a cool temperature and freedom from exposure to the air (see page 1438). When a fresh lot of ointment is made to replenish a stock jar, the jar should be thoroughly cleaned, and the old ointment remaining thrown away, unless it is certain that the latter is entirely free from rancidity, as otherwise it would soon cause the new ointment to become rancid. Amber glass, stoneware or porcelain jars are the best receptacles for ointments. Queen's-ware or china jars soon permit the fatty substance to penetrate through the minute fissures which are always present. Fig. 785 shows a German porcelain jar, which is just as useful for preserving ointments as it is for holding a penetrating substance like green soap. Fig. 786 illustrates an amber glass stock ointment jar made by the Whitall Tatum Company. The letters for the label are blown in the glass, and then ground off, so that the label is indestructible. The only difficulty is that the label requires a strong light to enable it to be seen clearly. For dispensing ointments the opal glass pot is very useful. The best shapes are shown in

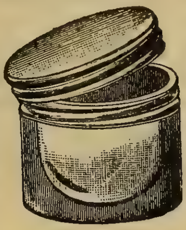
Figs. 787 and 787*a*. The bottom is rounded, so that the patient can easily reach all the ointment with the finger, and the top is metallic, with a screw cap. There is room for the label on the glass. The pot shown in Fig. 788 is not recommended. The bottom forms an angle with the sides which collects the ointment, the shoulder also catches a portion, while the wooden top is very apt to shrink, so that there is difficulty in getting it off without breaking it. Fig. 789 shows Fox, Fultz & Co.'s Sterling ointment pot. It is fitted with a metallic screw cap; the round label has a transparent celluloid disk above it and a heavy waxed disk below it, the whole making a grease-proof top to the pot. The glass box shown in Fig. 790 has a wooden top with a lithographed label. These are certainly the handsomest ointment boxes and the most expensive. The lids will often contract, however, and give trouble in getting them on and off. Of the very cheap boxes, those turned from wood are totally *unfit* for dispensing ointments. The ointment quickly penetrates through the grain of the wooden bottom, and the greasy abomination is ex-

Fig. 787



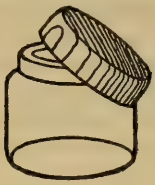
Ointment pot

Fig. 787*a*



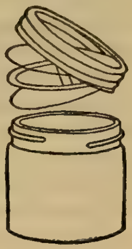
Ointment pot

Fig. 788



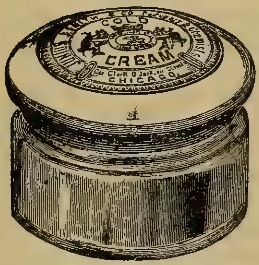
Ointment pot (wooden top)

Fig. 789



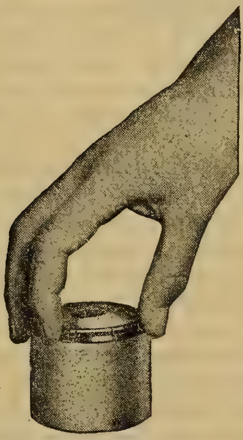
Sterling ointment pot

Fig. 790



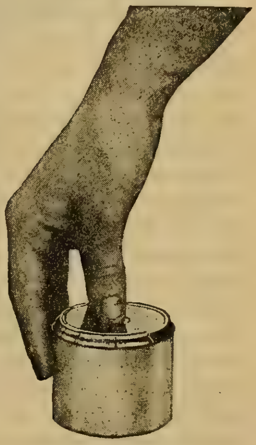
German ointment pot

Fig. 790a



Upressit pot

Fig. 790b



Upressit pot

ceedingly unwelcome to most housekeepers. A chip wood box covered with pasteboard is preferable, because it offers more resistance to the passage of the fatty substance. The impervious walnut boxes, made by gluing several veneers of hard wood together, are still better. Figs. 790*a* and 790*b* illustrate the "*Upressit*" ointment pot which may be readily opened or closed by pressing the centre or outer edge of the lid respectively. It is made by the United States Metal Cap and Seal Company of New York.

Collapsible Tubes.—A marked improvement in the method for the dispensing of ointments is now in general use. The method in use for many years has been to introduce the ointment to a pot or jar having a slip or screw lid. An ointment in such a container is frequently exposed to dust and is almost invariably removed from the jar, as used, by means of the finger. Both of these conditions are undesirable and unsanitary. In addition, the jar method of dispensing constantly exposes the ointment, over an extended surface, to the action of the air and frequently to the action of light, and this greatly hastens rancidity in the fatty vehicles used if these are of animal or vegetable origin.

The new plan, *i.e.*, dispensing ointments in pure tin, collapsible tubes, avoids all of the serious defects of the jar method and at the same time costs no more and is just as easily handled. Emphasis should be placed upon the use of pure tin tubes, as those made from composition metal are more readily attacked by certain ingredients which may enter ointments.

For eye ointments, special tubes, with nozzle-like outlets, are obtainable which facilitate the application of the ointment.

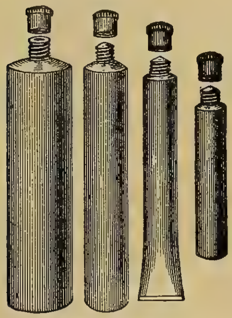
In closing a tube, care must be taken to see that it is not filled too full; it should be folded over at least twice. The capacity of each size of tube can be readily ascertained by a trial with petrolatum and this information may then become a permanent record for the prescription department.

Special plyers for closing tubes are obtainable at small cost; a check cancelling machine of the type which causes numerous small cuts in the check when stamped over the written numerals has been recommended for closing and is very satisfactory, but the back of a heavy table knife is quite as effective as the more expensive devices. In using a knife or stiff spatula, hold the filled tube in the left hand on a counter with the open end to the right, run the knife lightly along the tube to slightly flatten it, when near the end increase the pressure and, when within a quarter of an inch from the opening, hold the knife firmly and raise the tube, laying it over upon itself. Repeat this a second time and the tube is closed.

If a stiff ointment or other heavy substance is to be used in tubes, a hard metal clip should be clamped over the fold to prevent the contents being forced from the folded end when pressure is applied to the tube. The attachment of a clip, however, requires a special machine which is more expensive than the retailer will care to buy for prescription work alone. Fortunately, the consistence of most ointments is such that the clip is not needed, but it would be well to attach a sticker cautioning the patient to always press the tube from the folded end. For tooth pastes which are heavy and stiff in consistence, the clip is quite important if the container is to give satisfaction.

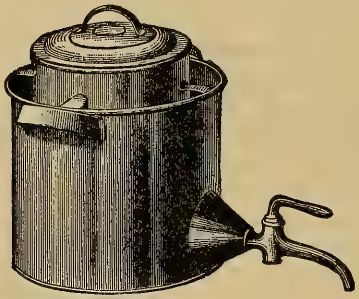
In filling the tubes with a soft ointment in prescription work, a method which has given much satisfaction because of its cleanliness, rapidity, and simplicity is as follows: Place the finished ointment in the center of a piece of manila or other strong paper of sufficient size (for an ounce of ointment use a sheet about 8 by 10 inches), fold it over so that the edges meet, with the ointment inside, place a pencil on the top fold on a counter, and, holding the under sheet, slowly roll the pencil toward the ointment. This causes it to form into a cylinder, and, when this is of a less diameter than the tube, roll this cylinder over on the remainder of the paper so as to form a paper tube with the ointment inside. Now slip this into the collapsible tube and start to fold over the protruding end of the paper tube. When the ointment has thus been forced completely into the metal tube, firmly grasp the metal end just below the paper and slowly withdraw the sheet, pulling with the other hand. This leaves the ointment inside and the tube is ready to close permanently. It has also been suggested that the paper be cut off and left inside the tube, but its withdrawal seems preferable.

FIG. 791



Collapsible tubes

FIG. 792



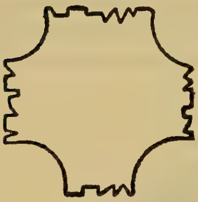
Alper's ointment filler

One difficulty always experienced is in the labeling of the tubes. If the label is to be attached, the tube may be dipped in compound tincture of benzoin or in a regular lacquer and afterwards allowed to dry. This will facilitate labeling and it is always desirable, if labels are applied, to use them in strip form so as to completely encircle the tube and prevent their coming off. Solution of sodium silicate has also been used on the tube and will cause the labels to stick. At best, however, labels are not very satisfactory, as the tube is likely to be completely rolled upon itself as the last of the ointment is used and the label soiled or destroyed, so that some pharmacists are using a pasteboard box to hold the tube and carry the label, while the tube itself is stamped in the tin with the prescription number, using a numbering machine. This will permit the identification of the prescription and its renewal, even if the box is lost.

Fig. 792 shows Alper's ointment filler. It consists of a tin kettle surrounded by a water bath, in such a way that the liquid ointment can easily be drawn through the stopcock. Small boxes, bottles, or collapsible tubes can quickly and easily be filled with petrolatum, ointment, or similar preparations, without the inconvenience of handling them in spoons or ladles.

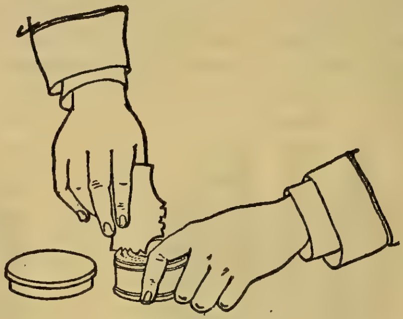
Finishing Ointment.—Some skill is required to fill a box with ointment neatly and deftly by using a spatula without soiling the exterior of the box. The surface is generally scraped with the edge of the spatula to give it a smooth finish, and then is sometimes held near a hot surface, like a stove plate, or played upon for a moment by the Bunsen flame, to give it a gloss. Occasionally it will be found that some nervous patients desire to be assured that an ointment or cerate has not been tampered with by a servant, and it may be desirable for other reasons to finish the surface of an ointment with a distinctive design. This may be done by cutting a piece of tin into a shape similar to that shown in Fig. 793. By placing one of the teeth on the edge of the pot (see Fig. 794), and slowly rotating it, with alternate pauses, a very neat finish may be given to the surface. The finisher (see Fig. 793) shows four sides, and is of course capable of making four patterns.

Fig. 793



Ointment finisher

Fig. 794



Finishing ointment

Inunctions

The N. F. has introduced two preparations, under this class name which are really ointments. They are intended for local application and quick absorption.

INUNCTUM MENTHOLIS. N. F. Menthol Inunction
[Inunct. Menthol.]

	Metric	Old form
Menthol	5 Gm.	87 gr.
Hydrous Wool Fat	95 Gm.	3 oz. av. 350 gr.
To make	100 Gm.	4 oz. av.

Rub the menthol with a portion of the hydrous wool fat until a perfectly smooth mixture is obtained, then thoroughly incorporate the remainder of the hydrous wool fat.

Menthol inunction should be kept in collapsible metal tubes, well sealed, or in small, tightly-stoppered, wide-mouthed bottles.

INUNCTUM MENTHOLIS COMPOSITUM. N. F. Compound Menthol Inunction

[Inunct. Menthol. Co.]

	Metric	Old form
Menthol	5 Gm.	87 gr.
Methyl Salicylate	10 Gm.	175 gr.
Hydrous Wool Fat	85 Gm.	3 oz. av. 175 gr.
To make	100 Gm.	4 oz. av.

Dissolve the menthol in the methyl salicylate and thoroughly incorporate the mixture in the hydrous wool fat.

Compound Menthol Inunction should be kept in collapsible metal tubes, well sealed, or in small, tightly-stoppered, wide-mouthed bottles.

GLYCEROGELATINA

Glycerogelatins

Glycerogelatins are soft masses, melting at the body temperature, composed of gelatin, glycerin, water, and a medicament suitable for application in dermatological practice, such as salicylic acid, iodoform, resorcinol, chrysarobin, etc., either by themselves, or with the addition of zinc oxide. They are prepared with Glycerinated Gelatin (U. S. P.) as the vehicle. The formulas which follow serve as types of Glycerogelatins modified to produce masses of different consistence and melting points.

GLYCEROGELATINUM ACIDI SALICYLICI. N. F. Salicylic Acid Glycerogelatin

[Glycerogel. Acid. Salicyl.]

	Metric	Old form
Glycerinated Gelatin	20 Gm.	350 gr.
Glycerin	35 Gm.	1 oz. av. 175 gr.
Distilled Water	35 mils	1 fl. oz. 175 min.
Salicylic Acid, in very fine powder	10 Gm.	175 gr.
To make	100 Gm.	4 oz. av.

Mix the salicylic acid thoroughly with the glycerin, add the distilled water, and incorporate this mixture with the glycerinated gelatin previously melted on a water bath. Continue the heat, with stirring, until a homogeneous mixture is obtained, then pour it into chilled moulds and allow it to congeal.

GLYCEROGELATINUM IODOFORMI. N. F. Iodoform Glycerogelatin

[Glycerogel. Iodof.]

	Metric	Old form
Glycerinated Gelatin	10 Gm.	175 gr.
Glycerin	15 Gm	262 gr.
Distilled Water	65 mil	2 fl. oz. 262 min.
Iodoform, in very fine powder	10 Gm.	175 gr.
To make	100 Gm.	4 oz. av.

Mix the iodoform thoroughly with the glycerin, add the distilled water and incorporate this mixture with the glycerinated gelatin, previously melted on a water bath. Continue the heat, with stirring, until a homogeneous mixture is obtained, then pour it into chilled moulds and allow it to congeal.

GLYCEROGELATINUM ZINCI DURUM. N. F. Firm Zinc Glycerogelatin

[Glycerogel. Zinc. Dur.]

	Metric	Old form
Glycerinated Gelatin	30 Gm.	1 oz. av. 87 gr.
Glycerin	25 Gm.	1 oz. av.
Distilled Water	35 mils	1 fl. oz. 175 min.
Zinc Oxide, in fine powder	10 Gm.	175 gr.
To make	100 Gm.	4 oz. av.

Mix the zinc oxide thoroughly with the glycerin, add the water and incorporate this mixture with the glycerinated gelatin, previously melted on a water bath. Continue the heat, with stirring, until a homogeneous mixture is obtained, then pour it into chilled moulds and allow it to congeal.

GLYCEROGELATINUM ZINCI MOLLE. N. F. Soft Zinc Glycerogelatin

[Glycerogel. Zinc. Mol.]

	Metric	Old form
Glycerinated Gelatin	20 Gm.	350 gr.
Glycerin	35 Gm.	1 oz. av. 175 gr.
Distilled Water	35 mils	1 fl. oz. 175 min.
Zinc Oxide, in fine powder	10 Gm.	175 gr.
To make	100 Gm.	4 oz. av.

Mix the zinc oxide thoroughly with the glycerin, add the water and incorporate this mixture with the glycerinated gelatin, previously melted on a water bath. Continue the heat, with stirring, until a homogeneous mixture is obtained, then pour it into chilled moulds and allow it to congeal.

PASTÆ DERMATOLOGICÆ

Dermatologic Pastes

Dermatologic Pastes are medicaments for external use, employed in the practice of dermatologists. They are ointment-like mixtures of starch, dextrin, zinc oxide, sulphur, calcium carbonate or other medicinal substances made into a paste with glycerin, soft soap, petrolatum, lard, or other fats medicated with antiseptic or astringent agents. The formulas which follow serve as examples.

PASTA BETANAPHTHOLIS. N. F. Betanaphthol Paste

[Past. Betanaphthol.—Pasta Naphtholis, Lassar, N. F. III Lassar's Naphthol Paste]

	Metric	Old form
Betanaphthol, in very fine powder	10 Gm.	175 gr.
Precipitated Sulphur	50 Gm.	2 oz. av.
Petrolatum	20 Gm.	350 gr.
Soft Soap	20 Gm.	350 gr.
To make	100 Gm.	4 oz. av.

Triturate the betanaphthol and sulphur with the petrolatum and then incorporate the soft soap with the mixture.

PASTA DEXTRINATA. N. F. Dextrinated Paste

[Past. Dextrin.]

	Metric	Old form
White Dextrin	33 Gm.	1 oz. av. 140 gr.
Glycerin	33 Gm.	1 oz. av. 140 gr.
Water, a sufficient quantity,		
To make	100 Gm.	4 oz. av.

Dissolve the dextrin in the glycerin and 33 mils [old form 1 fluidounce 27 minims] of water, in a tared dish with the aid of heat, and add sufficient water to make the product weigh 100 Gm. [old form 4 ounces av.]

PASTA RESORCINOLIS FORTIS. N. F. Strong Resorcinol Paste

[Past. Resorcin. Fort.—Lassar's Stronger Resorcinol Paste]

	Metric	Old form
Resorcinol	20 Gm.	350 gr.
Zinc Oxide	20 Gm.	350 gr.
Starch	20 Gm.	350 gr.
Light Liquid Petrolatum	40 Gm.	1 oz. av. 262 gr
To make	100 Gm.	4 oz. av.

Thoroughly triturate the zinc oxide with sufficient of the liquid petrolatum to make a thin, smooth paste. Reduce the resorcinol to a very fine powder, mix it with the starch, add the mixture to the zinc oxide paste and triturate until a uniformly smooth product is obtained. Then gradually incorporate the remainder of the liquid petrolatum.

PASTA RESORCINOLIS MITIS. N. F. Mild Resorcinol Paste

[Past. Resorcin. Mit.—Lassar's Mild Resorcinol Paste Pasta Resorcini, Lassar, N. F. III.]

	Metric	Old form
Resorcinol	10 Gm.	175 gr.
Zinc Oxide	25 Gm.	1 oz. av.
Starch	25 Gm.	1 oz. av.
Light Liquid Petrolatum	40 Gm.	1 oz. av. 262 gr.
To make	100 Gm.	4 oz. av.

Thoroughly triturate the zinc oxide with sufficient of the liquid petrolatum to make a thin smooth paste. Reduce the resorcinol to a very fine powder, mix it with the starch, add the mixture to the zinc oxide paste and triturate until a uniformly smooth product is obtained. Then gradually incorporate the remainder of the liquid petrolatum.

PASTA ZINCI. N. F. Zinc Paste

[Past. Zinc.—Lassar's Zinc Paste Pasta Zinci Lassar, N. F. III.]

	Metric	Old form
Salicylic Acid, in fine powder	2 Gm.	35 gr.
Zinc Oxide	24 Gm.	420 gr.
Starch	24 Gm.	420 gr.
Petrolatum	50 Gm.	2 oz. av.
To make	100 Gm.	4 oz. av.

Thoroughly triturate the zinc oxide with a portion of the petrolatum, then add the salicylic acid, starch, and the remaining petrolatum and rub them until a perfectly smooth mixture is obtained.

PASTA ZINCI MOLLIS. N. F. Soft Zinc Paste

[**Past. Zinc. Moll.**—Unna's Soft Zinc Paste Pasta Zinci Mollis, Unna, N. F. III.]

	Metric	Old form
Zinc Oxide	25 Gm.	1 oz. av.
Precipitated Calcium Carbonate	25 Gm.	1 oz. av.
Linseed Oil	25 Gm.	1 oz. av.
Solution of Calcium Hydroxide	25 Gm.	1 oz. av.
To make	100 Gm.	4 oz. av.

Thoroughly triturate the zinc oxide and the precipitated calcium carbonate with the linseed oil, gradually added, so as to form a perfectly smooth mixture, and then incorporate the solution of calcium hydroxide.

PASTA ZINCI SULPHURATA. N. F. Sulphurated Zinc Paste

[**Past. Zinc. Sulphur.**—Unna's Sulphurated Zinc Paste Pasta Zinci, Sulphurata, Unna, N. F. III.]

	Metric	Old form
Zinc Oxide	15 Gm.	262 gr.
Precipitated Sulphur	10 Gm.	175 gr.
Purified Siliceous Earth	5 Gm.	87 gr.
Benzoinated Lard	70 Gm.	2 oz. av. 350 gr.
To make	100 Gm.	4 oz. av.

Mix the powders and triturate them with about an equal weight of benzoinated lard until a smooth mixture is obtained. Then incorporate the remainder of the benzoinated lard.

Cataplasmæ *Poultices*

Only one poultice is official. They are usually used in domestic practice and made in the home. The materials for *spice poultice* are recognized in the N. F. under the title Pulvis Aromaticus Rubifaciens (see page 1706).

CATAPLASMA KAOLINI. N. F. Cataplasm of Kaolin

(U. S. P. VIII)

[**Catapl. Kaolin.**]

	Metric	Old form
Kaolin, recently dried at 110° C. (230 °F.) and cooled, and in very fine powder	565.0 Gm.	9 oz. av. 17 gr.
Boric Acid, in very fine powder	45.0 Gm.	315 gr.
Thymol	0.5 Gm.	3½ gr.
Methyl Salicylate	2.0 Gm.	14 gr.
Oil of Peppermint	0.5 Gm.	3½ gr.
Glycerin, recently heated to 100° C. (212 °F.)	387.0 Gm.	6 oz. av. 84 gr.
To make about	1000 Gm.	16 oz. av.

Mix the kaolin with the boric acid, and then thoroughly incorporate the warm glycerin. Finally add the thymol, dissolved in the methyl salicylate and oil of peppermint, and make into a homogeneous mass. Preserve it in air-tight containers.

Uses.—The large demand for an external application containing glycerin led to the introduction of this cataplasm in the U. S. P. VIII, but it has now been transferred to the N. F.; it is used to allay inflammation in the treatment of pneumonia, boils, carbuncles, etc., and in dermatological practice. Care should be taken to thoroughly dry both the kaolin and the glycerin for this preparation, as its value largely depends upon its ability to absorb moisture, and this is greatly increased when all ingredients are anhydrous. The heating also sterilizes the kaolin and decomposes any carbonate which may be present. In fact, it is desirable to heat the cataplasm, agitating it with mechanical stirrers, for some time before the oils are added, to eliminate the tendency to effervesce. The boxes in which it is sold should be of the so-called seamless type, as other styles are likely to leak.

Emplastra *Plasters*

Plasters are substances intended for external application and are of such consistence that they adhere to the skin, and require the aid of heat in spreading them. The word "plaster" is applied not only to the solid substance which is spread upon the muslin, leather, paper, or other material which serves to hold it, but to the spread plaster itself. The basis of most plasters is either made from rubber, lead plaster, gum resin, or Burgundy pitch.

In the preparation of plasters, care is requisite that the heat employed be not sufficiently elevated to produce decomposition, nor so long continued as to drive off any volatile ingredient upon which the virtues of the preparation may in any degree depend. After having been prepared, they are usually shaped into cylindrical rolls, and wrapped in paper to exclude the air. Plasters should be firm at ordinary temperatures, should spread easily when heated, and, after being spread, should remain soft, pliable, and adhesive, without melting, at the heat of the human body. When long kept, they are apt to change color and to become hard and brittle, and, as this alteration is most observable upon their surface, it must depend chiefly upon the action of the air, which should therefore be excluded as much as possible. The defect may usually be remedied by melting the plaster with a moderate heat and adding a sufficient quantity of oil to give it the due consistence. To soften the surface of a spread plaster, it should be brushed with a little tincture of camphor. *Nine* plasters are official.

U. S. P. Plasters

Emplastrum Belladonnæ	The commercial plaster containing 30 per cent. of Extract of Belladonna Leaves and yielding from 0.35 to 0.40 per cent. of belladonna alkaloids
Cantharidis	Made by spreading Cantharides Cerate upon Rosin Plaster leaving a margin around the edge
Capsici	Made by applying Oleoresin of Capsicum to Rubber Plaster; (0.25 Gm. of Oleoresin over a surface 15 centimeters square)
Elasticum	Made from a mixture of rubber, resins and waxes with a filler of an absorbent powder, such as orris root or starch, mechanically mixed and spread upon cotton cloth or other fabric
Plumbi	Made by heating 1000 Gm. of Olive Oil and 1000 Gm. of Lard until liquefied in a bright copper or other suitable vessel. Sift 1000 Gm. of Lead Oxide upon the hot liquid, then gradually add 350 mils of Boiling Water and heat and stir until a homogeneous mass results. Remove from the fire, wash, and knead the mass until free from water
Resinæ	Made by melting 800 Gm. Lead Plaster and 60 Gm. Yellow Wax at a gentle heat, adding 140 Gm. of Rosin, and, when uniformly melted, mixing thoroughly until it cools
Sinapis	Made from a uniform mixture of powdered black mustard (deprived of its fixed oil) and a solution of rubber spread on paper or cloth

N. F. Plasters

Emplastrum Fuscum Camphoratum	Made by heating 30 Gm. of Red Oxide of Lead with 55 Gm. of Olive Oil until small portions, dropped into water, congeal to a firm consistence. Then remove it from the fire, add 15 Gm. of Yellow Wax and 1 Gm. of Camphor, previously rubbed to a smooth paste with 5 Gm. of Olive Oil. Mix and pour into paper moulds to cool.
Saponis. U. S.P. VIII	Made by rubbing 10 Gm. of Soap with sufficient Water to form a soft mass; then mixing thoroughly with 90 Gm. of Lead Plaster, previously melted.

Unofficial Plasters

Name	Ingredients	Preparation
Emplastrum Adhesivum. U. S. P. VIII	20 Gm. of Rubber; 20 Gm. of Petrolatum; 960 Gm. of Lead Plaster	Melt the Rubber, add the Petrolatum heating until dissolved, then incorporate the Lead Plaster and stir until the mass stiffens
Ammoniaci cum Hydrargyro. U. S. P. 1890	720 Gm. Ammoniac; 180 Gm. Mercury; 8 Gm. Oleate of Mercury; 1000 mils Diluted Acetic Acid; Lead Plaster to make 1000 Gm.	Digest the Ammoniac with the Acid until perfectly emulsified, strain and evaporate, on a water bath, until it hardens on cooling. Extinguish the Mercury in the Oleate of Mercury by trituration, add the Ammoniac while yet hot and finally enough melted Lead Plaster to make 1000 Gm. Mix the whole thoroughly
Arnicæ. U. S. P. 1890	330 Gm. Extract of Arnica Root; 670 Gm. Resin Plaster	Add the Extract to the melted Resin Plaster and mix thoroughly
Calefaciens. Br. Warming Plaster	0.2 Gm. Cantharidin; 20 mils of Chloroform; 40 mils of Olive Oil; 940 Gm. Resin Plaster	Dissolve the Cantharidin in the Chloroform, add the Olive Oil and then the melted Resin Plaster
Cantharidini. Br.	2 Gm. Cantharidin; 100 mils Chloroform; 450 Gm. Yellow Beeswax; 1000 Gm. Wool Fat	Dissolve the Cantharidin in the Chloroform, add this solution to the other ingredients previously melted, stir until cold
Hydrargyri. Br.	328 Gm. of Mercury; 18 Gm. of Olive Oil; 2 Gm. Sublimed Sulphur; 652 Gm. of Lead Plaster	Heat the Olive Oil with the Sulphur until a reddish-brown liquid is obtained; triturate the Mercury until it is extinguished, then add the Lead Plaster, previously melted
Ferri. U. S. P. 1890 (Strengthening-Plaster)	90 Gm. Ferric Hydrate; 50 Gm. Olive Oil; 140 Gm. Burgundy Pitch; 720 Gm. Lead Plaster	Melt the Lead Plaster and Burgundy Pitch on a water bath, add the Olive Oil, then the Ferric Hydrate, and stir until cool
Ichthyocollæ. U. S. P. 1890	10 Gm. Isinglass; 40 Gm. Alcohol; 1 Gm. Glycerin; Water and Tincture of Benzoin, a sufficient quantity	Dissolve the Isinglass in sufficient hot water to make 120 Gm. Spread one-half of this, in successive layers, on a piece of taffeta, 38 cm. square, held in a frame, allowing each layer to dry. Add the Alcohol and Glycerin to the remainder of the Isinglas solution and apply it in the same manner, then coat the reverse side of the taffeta with Tincture of Benzoin and, when dry, cut it into suitable pieces
Menthol. Br.	150 Gm. Menthol; 100 Gm. Yellow Beeswax; 750 Gm. Resin	Melt the Beeswax and Resin together and at about 70° C. (158° F.) dissolve the Menthol in the melted mixture
Opii. U. S. P. VIII	6 Gm. Extract Opium; 8 mils of Water; 90 Gm. of melted Adhesive Plaster	Rub the Opium with the water until a paste results, add the Adhesive Plaster and continue heating until the mixture weighs 100 Gm.
Picis Br. 1898	520 Gm. Burgundy Pitch; 260 Gm. Frankincense; 90 Gm. Resin; 90 Gm. Yellow Beeswax; 40 Gm. Olive Oil; 40 mils Water	Add the Olive Oil and water to the other ingredients, previously melted, and evaporate to a proper consistence
Picis Burgundicæ. U. S. P. 1890	800 Gm. Burgundy Pitch; 50 Gm. Olive Oil; 150 Gm. Yellow Wax	Add the Olive Oil to the melted Burgundy Pitch and Wax, strain, and stir constantly until cool
Picis Cantharidatum. U. S. P. 1890	80 Gm. Cantharides Cerate; Burgundy Pitch to make 1000 Gm.	Melt the Cerate, strain out and discard the Cantharides, add sufficient melted Burgundy Pitch to the Cerate to weigh 1000 Gm., and stir during the cooling
Plumbi Iodidi Br. 1898	50 Gm. Lead Iodide; 400 Gm. Lead Plaster; 50 Gm. Resin	Mix the finely powdered Lead Iodide with the melted Lead Plaster and Resin at a low temperature

EMPLASTRUM RESINÆ. U. S. Rosin Plaster

[Emp. Res.—Rosin Adhesive Plaster Adhesive Plaster]

	Metric	Old form
***Rosin**, in fine powder	140 Gm.	2 oz. av. 105 gr.
Lead Plaster	800 Gm.	12 oz. av. 350 gr.
Yellow Wax	60 Gm.	420 gr.
To make	1000 Gm.	16 oz. av.

Melt the lead plaster and yellow wax together with a gentle heat, then add the rosin and, when melted, mix thoroughly, strain, and allow the product to cool, stirring until it stiffens.

EMPLASTRUM BELLADONNÆ. U. S. Belladonna Plaster

[Emp. Bellad.]

An adhesive plaster containing 30 per cent. of extract of belladonna leaves and yielding not less than 0.35 per cent. nor more than 0.40 per cent. of the alkaloids from belladonna leaves.

Assay.—Introduce 10 Gm. of Belladonna Plaster into a 100-mil flask. (If the plaster is spread on fabric, cut the portion to be assayed into strips, weigh it accurately, and introduce it into the flask.) Now add 50 mils of chloroform and shake the mixture until the plaster is dissolved. Pour the chloroform solution into a 250-mil beaker and wash the cloth upon which the plaster was spread with two portions of 25 mils each of chloroform, adding the washings to the chloroform solution in the beaker. Then wash this cloth with 80 mils of alcohol containing 1 mil of ammonia water and pour the washings into the chloroform solution in the beaker. Stir the mixture gently and allow it to stand until the rubber has separated into a compact mass. Dry the cloth upon which the plaster was spread, weigh it and subtract its weight from the original weight of the plaster. Pour the chloroform-alcohol solution into a 350-mil separator, rinse the beaker and rubber with 10 mils of alcohol and add the rinsing to the separator. Then add to the separator 100 mils of distilled water, rotate until thoroughly mixed and allow it to stand until the liquids separate. Then draw off the chloroform into a second separator containing 50 mils of distilled water, shake it thoroughly and after separation draw off the chloroform into a beaker and pour the aqueous solution into the first separator. Return the chloroform solution to the second separator and shake out the contents of the first separator with two portions of 10 and 5 mils, respectively, of chloroform, adding them to the chloroform in the second separator. Completely extract the alkaloids from the chloroform solution by shaking it out repeatedly with weak sulphuric acid. Collect the acid washings in a separator and add ammonia water until the solution is decidedly alkaline to litmus, and completely extract the alkaloids by shaking out repeatedly with chloroform. Filter the chloroform solution through a pledget of cotton, evaporate it to dryness and dissolve the alkaloids from the residue in exactly 5 mils of tenth-normal sulphuric acid V.S., and titrate the excess of acid with fiftieth-normal potassium hydroxide V.S., using cochineal T.S. as indicator (see Proximate Assays, Chapter LXII).

Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 28.92 milligrammes of the alkaloids from belladonna leaves.

EMPLASTRUM CAPSICI. U. S. Capsicum Plaster

[Emp. Capsic.]

***Oleoresin of Capsicum,**
Rubber Plaster, spread on fabric, each, a sufficient quantity.

Apply oleoresin of capsicum to the surface of rubber plaster so as to form a thin, even coating, leaving a margin around the edges.

Each fifteen square centimeters of spread plaster contains 0.25 Gm. of oleoresin of capsicum.

EMPLASTRUM CANTHARIDIS. U. S. **Cantharides Plaster**

[Emp. Canthar.]

***Cantharides Cerate,**
Rosin Plaster, spread of fabric, each, a sufficient quantity.

Spread cantharides cerate upon rosin plaster, leaving a margin around the edges. It may also be spread on muslin, paper, or other suitable material. This Plaster should not be dispensed unless it has been recently prepared.

Each square centimeter of spread plaster contains 0.1 Gm. of cantharides cerate.

EMPLASTRUM ELASTICUM. U. S. **Rubber Plaster**

[Emp. Elast.—RUBBER ADHESIVE PLASTER]

A mixture of rubber, resins and waxes, with a filler of an absorbent powder, such as orris root or starch, mechanically mixed and spread upon cotton cloth or other fabric.

EMPLASTRUM PLUMBI. U. S. **Lead Plaster**

[Emp. Plumb.—DIACHYLON PLASTER]

	Metric	Old form
***Lead Oxide**	1000 Gm.	1 lb. av.
Olive Oil	1000 Gm.	1 lb. av.
Lard	1000 Gm.	1 lb. av.

Boiling Water, a sufficient quantity.

Heat the olive oil and lard by a gentle heat until liquefied in a bright copper or other suitable vessel of a capacity of not less than four times the bulk of the ingredients, sift the lead oxide, through a No. 80 sieve, upon the surface of the hot liquid and mix thoroughly. Then gradually add 350 mils [old form about 6 fluidounces] of boiling water, and boil the mixture, constantly stirring, with a wooden spatula, and adding sufficient boiling water, from time to time, to replace that lost by evaporation, until the mass is homogeneous and a small portion removed and dipped into cold water is found to be pliable and tenacious. Then remove it from the fire and wash several times with warm water to remove the glycerin. Finally knead the mass until it is free from water, roll it into cylinders of suitable size, and wrap them in paper.

U. S. P. Preparations.—Emplastrum Resinæ; Unguentum Diachylon.
N. F. Preparation.—Emplastrum Saponis.

The U. S. P. VIII method for making lead plaster is a practical process for its extemporaneous preparation and it is therefore given here in full:

	Metric	Old form
Soap, dried, and in coarse powder	100 Gm.	3 oz. av. 231 gr.
Lead Acetate	60 Gm.	2 oz. av. 51 gr.
Water, a sufficient quantity.		

Dissolve the soap in 350 mils [old form 15 fl. oz.] of hot water and strain the solution. Dissolve the lead acetate in 250 mils [old form 8½ fl. oz.] of hot water, and at once filter the solution into the warm soap solution, stirring constantly.

When the precipitate has subsided, decant the liquid, and wash the precipitate thoroughly with hot water. Transfer the mass to a warm slab, kneading it thoroughly to free it from water. Finally, roll the plaster into cylindrical forms and wrap them in paraffined paper.

EMPLASTRUM SINAPIS. U. S. Mustard Plaster

[**Emp. Sinap.**—CHARTA SINAPIS, U.S.P. VIII MUSTARD PAPER]

A uniform mixture of powdered black mustard (deprived of its fixed oil) and a solution of rubber, spread on paper, cotton cloth or other fabric. Preserve it in tightly-closed containers.

A square of 100 square centimeters contains not less than 2.5 Gm. of black mustard deprived of its fixed oil.

When moistened thoroughly with tepid water and applied to the skin, the Plaster produces a decided warmth and reddening of the skin within five minutes.

Before Mustard Plaster is applied, moisten it thoroughly with tepid water.

EMPLASTRUM FUSCUM CAMPHORATUM. N. F. Camphorated Brown Plaster

[**Emp. Fusc. Camph.**—CAMPHORATED MOTHER PLASTER]

	Metric	Old form
Red Oxide of Lead	30 Gm.	1 oz. av. 25 gr.
Olive Oil	60 Gm.	2 oz. av. 51 gr.
Yellow Wax	15 Gm.	231 gr.
Camphor	1 Gm.	15 gr.

Triturate the red oxide of lead with 55 Gm. [old form 1 ounce av., 411 grains] of the oil in a suitable kettle until a smooth paste results, and boil the mixture over a fire, with constant stirring, until gas bubbles rise or until the red color of the mixture begins to turn brown. Then moderate the heat, but continue the stirring until the mixture has acquired a dark-brown color. From time to time allow a few drops of it to fall into cold water to test its consistence, and when these congeal to a firm consistence remove the vessel from the fire, add the wax, cut into small pieces, and finally the camphor, previously rubbed to a smooth paste with the rest of the olive oil. Mix thoroughly, allow the mixture to cool somewhat, and while still warm pour it into paper moulds, previously coated with mucilage of acacia containing about five per cent. of glycerin and allowed to dry.

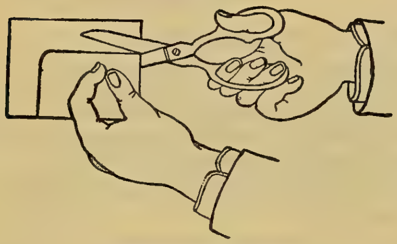
EMPLASTRUM SAPONIS. N. F. Soap Plaster
(U. S. P. VIII)
[Emp. Sapon.]

	Metric	Old form
Soap, dried, and in coarse powder	10 Gm.	175 gr.
Lead Plaster	90 Gm.	3 oz. av. 262 gr.
Water, a sufficient quantity,		
To make about	100 Gm.	4 oz. av.

Rub the soap with enough water to reduce it to a semi-liquid, mix it with the lead plaster, previously melted, incorporate thoroughly by stirring, and evaporate the mixture to the consistence of a plaster.

Spreading Plasters.—Since the introduction of machine-spread plasters, the preparation of a plaster by a pharmacist upon the prescription of a physician has become almost a "lost art."

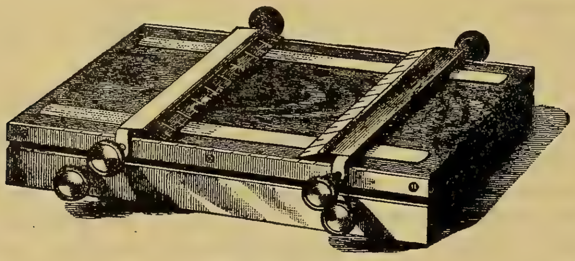
Fig. 795



Cutting plaster paper

Plasters are prepared for use by spreading them upon leather, muslin, paper, or adhesive plaster, according to the particular purpose for which they are intended. Leather is most convenient when the application is made to the sound skin, muslin when the plaster is used as a dressing to ulcerated or abraded surfaces or with the view of bringing and retaining together the sides of wounds. The leather usually preferred is white sheepskin, or the kind known commercially as "hemlock splits." A margin about a quarter or half an inch broad should usually be left uncovered, in order to facilitate the removal of the plaster and to prevent the clothing from coming into contact with its edges. An accurate outline may be obtained by pasting, or fastening with thumb tacks, upon the leather a piece of paper so cut as to leave in the center a vacant space of the required dimensions, and removing the paper after the plaster is spread. The paper is folded four times. Fig. 795 shows one-fourth of the whole in the act of being cut. The rounded corners give a neater finish than square ones. The same object may often be accomplished by employing two narrow rulers of sheet tin, graduated in inches, and so shaped that each of them will form two sides of a rectangle. These may be applied in such a manner as to enclose within them any given rectangular space, and may be fixed by weights upon the leather, or pref-

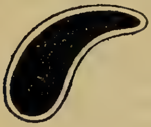
Fig. 796



The Franciscus plaster board

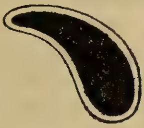
erably adjusted by set screws, while the plaster is being spread. The Franciscus machine is constructed on this principle (see Fig. 796).[1] For any other shape, as in the case of plasters for the breast, pieces of tin may be employed having a space within, corresponding to the required outline. Figs. 797, 798, 799, 800, 801, 802, 803, and 804 show patterns for plasters with margins for various parts of the body. Figs. 797 and 798 are for use behind the ears, the pointed portion of the plasters being used for the top. Care must be observed to have the physician designate whether the plaster is intended for the right ear (Fig. 798) or the left ear (Fig. 797). Chest plasters are sometimes cut in the shape of Fig. 799; those intended for use between the shoulders may have the form of Fig. 800. In Fig. 801 a plaster is shown which is intended for the "small of the back," and in Fig. 802 is one for either the right or the left side. Fig. 803 shows a pattern for fastening to kid, to spread a breast plaster on, and Fig. 804 represents the plaster with the margin as spread from such a pattern. The spreading of the plaster is most conveniently accomplished by the use of a spatula or plaster iron (see Fig. 806). This may be heated by means of a spirit lamp. Care must be taken that the instrument be not so hot as to discolor or decompose the plaster, and special care is requisite in the case of those plasters which contain a volatile ingredient. A sufficient portion of the plaster should first be melted by the heated instrument, and, having been received on a piece of coarse, stiff paper, or in a shallow tin tray open on one side, should, when nearly cool, be transferred to the leather and applied quickly and evenly over its surface. By this plan the melted plaster is prevented from penetrating the leather, as it would be apt to do if applied too hot. Before removing the paper from the edge of the plaster, if this has become so hard as to crack, the iron should be drawn over the line of junction. Fig. 805 shows one method of spreading a small plaster with a spatula. Strips of paper are fastened upon the kid with thumb tacks (such as are used by draughtsmen, as shown in the

FIG. 797



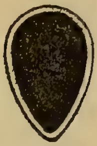
Left ear plaster

FIG. 798



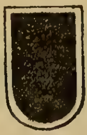
Right ear plaster

FIG. 799



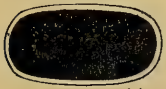
Chest plaster

FIG. 800



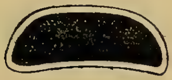
Shoulder plaster

FIG. 801



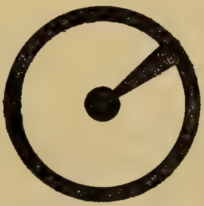
Back plaster

FIG. 802



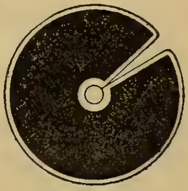
Side plaster

FIG. 803



Breast plaster pattern

FIG. 804



Breast plaster

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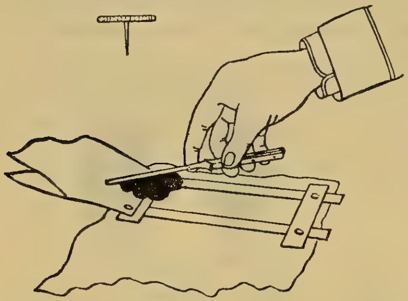
[1] The other side of this valuable apparatus can be used as a lozenge board or pill machine.

upper part of Fig. 805), a piece of waste paper is fastened at the top to prevent soiling the margin, the melted plaster is poured upon it, and the spatula, having been previously warmed by passing it through an alcohol flame or that of a Bunsen burner, is used by quickly passing the edge of the blade over the surface; a portion of the melted plaster precedes the blade in its passage, and thus a thin layer is spread upon the leather. Especial care must be observed not to allow very hot plaster to remain upon the leather, or it may pass through and discolor the back. For large plasters the plaster iron (see Fig. 806) may be employed. This is heated, and, owing to the greater weight of metal, it holds the heat much better than the blade of a spatula. It is, however, not so easily nor so quickly used as the latter instrument by those unaccustomed to it. After the plaster has been spread, the strips of paper are carefully removed, and if the plaster is brittle it should be held near the source of heat, so that the strips may be removed without tearing off pieces of the plaster from the leather.

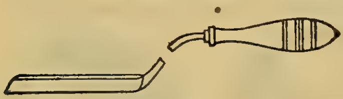
Fig. 805



Spreading a plaster

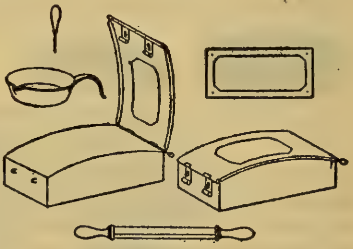
Large quantities of stock plasters may be spread by the apparatus shown below. To an oblong rectangular block of hard wood, slightly convex on its upper surface, is attached by a movable joint a sheet iron frame, with an opening of the dimensions of the plaster to be spread, and clasps at the other end, by which this may be fixed to the block (see Fig. 807). Another portion of the apparatus is a sheet iron or tin frame, by which the leather is cut out and the margin marked. The leather thus prepared is laid on the convex surface of the block; the iron frame is brought down on it evenly; the plaster, previously melted, but not too hot, is poured on the leather in the centre, and, by means of a square iron bar having a wooden handle at each end (see lower part of Fig. 807), which has been heated by a spirit lamp, it is spread uniformly over the surface, the thickness being regulated by the frame against which the iron is pressed. Any excess of plaster is thus pressed over upon the frame. The heated point of an awl (see Fig. 807, upper left corner) is then drawn along the interior edge of the frame so as to separate the plaster from it, after which the clasps are unfastened and the plaster removed.

Fig. 806



Plaster iron

Fig. 807

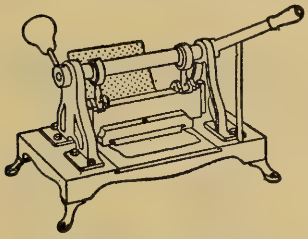


Plaster spreading apparatus

The dipper shown in Fig. 807 is well adapted for holding suitable quantities for spreading plasters extemporaneously. If a portion of the various roll plasters be melted and run into a number of these, and the dippers labelled, they will be found very convenient as containers. Fig. 808 shows a machine for perforating or "porousing" plasters.

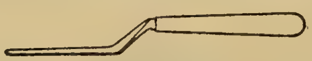
Blisters do not usually require the application of heat to spread them. They may be spread on adhesive plaster in the same way as plasters are prepared. The spatula shown in Fig. 809 is well fitted for spreading blisters, as it gives room for the fingers and permits a solid grasp of the handle. The practice of using the thumb in spreading blisters, although tolerated by many good pharmacists, should be regarded as more honored in the breach than in the observance. It is an unnecessary and inelegant procedure, the spatula giving a much smoother finish.

Fig. 808



Plaster perforating machine

Fig. 809



Blister spatula

MULLÆ

Mulls

Salve Mulls Steatins

Mulls are ointments of high fusing points, containing the desired medicinal agent, and spread on soft muslin or "mull" in a manner similar to the ordinary spread plasters. Although these mulls are more conveniently produced with the aid of special mechanical appliances, it is quite practicable to prepare them on a limited scale as follows:

Spread a sheet of moistened parchment paper on a smooth surface, wipe off the excess of moisture with a cloth, evenly stretch a corresponding piece of unsized mull upon the parchment paper and hold it in place with thumb-tacks. Then spread the previously melted and partly cooled ointment evenly on the mull by means of a broad, flat bristle-brush, and, when a sufficient layer has been applied in this way, smooth the surface by the aid of two elastic spatulas, heated by immersion in hot water, wiped dry, and used alternately to expedite the operation. A smooth surface having been produced, remove the thumb-tacks and withdraw the mull from the parchment paper, the operation being facilitated by fastening the uncoated end of the mull upon a flat stick of wood. Then suspend the mull on a string in a cool room, and when thoroughly chilled, cover it with paraffin paper and roll it into a cylinder.

The most suitable base for preparing Mulls is a mixture of suet and lard, in suitable proportions, with occasional addition of wax or lead plaster—this depending upon the nature of the medicinal component, or the intended use. The following formulas may serve as examples:

MULLA ACIDI SALICYLICI. N. F. **Salicylic Acid Mull**

[**Mull. Ac. Salicyl.**—Unguentum Salicylatum Extensum, N.F. III]

	Metric	Old form
Salicylic Acid	**10 Gm.**	**175 gr.**
Benzoinated Suet	**80 Gm.**	**3 oz. av. 87 gr.**
Benzoinated Lard	**10 Gm.**	**175 gr.**
To make	**100 Gm.**	**4 oz. av.**

Mix the salicylic acid intimately with the benzoinated lard and then incorporate the benzoinated suet. Spread the mull as needed.

MULLA CREOSOTI SALICYLATA. N. F. **Salicylated Creosote Mull**

[**Mul. Creosot. Salicyl.**—Unguentum Creosoti Salicylatum Extensum, N.F. III]

	Metric	Old form
Salicylic Acid	**10 Gm.**	**175 gr.**
Creosote	**20 Gm.**	**350 gr.**
Yellow Wax	**5 Gm.**	**87 gr.**
Benzoinated Suet	**65 Gm.**	**2 oz. av. 262 gr.**
To make	**100 Gm.**	**4 oz. av.**

Melt the yellow wax, add the benzoinated suet, and then incorporate the creosote and salicylic acid, and stir until the product congeals. Spread the mull as needed.

MULLA HYDRARGYRI CHLORIDI CORROSIVI. N. F. **Corrosive Mercuric Chloride Mull**

[**Mull. Hydrarg. Chlor. Corros.**—Unguentum Hydrargyri Chloridi Corrosivi Extensum, N.F. III]

	Metric	Old form
Corrosive Mercuric Chloride	**2 Gm.**	**3½ gr.**
Alcohol	**60 mils**	**105 min.**
Benzoinated Suet	**900 Gm.**	**3 oz. av. 262½ gr.**
Benzoinated Lard	**50 Gm.**	**87½ gr.**
To make	**1000 Gm.**	**4 oz. av.**

Dissolve the corrosive mercuric chloride in the alcohol, incorporate this with the benzoinated lard, and then incorporate the benzoinated suet. Avoid contact with metallic implements or containers. Spread the mull as needed.

MULLA ZINCI. N. F. **Zinc Mull**

[**Mull. Zinc.** Unguentum Zinci Extensum, N.F. III]

	Metric	Old form
Zinc Oxide	**10 Gm.**	**175 gr.**
Benzoinated Suet	**70 Gm.**	**2 oz. av. 350 gr.**
Benzoinated Lard	**20 Gm.**	**350 gr.**
To make	**100 Gm.**	**4 oz. av.**

Mix the zinc oxide intimately with the benzoinated lard and then incorporate the benzoinated suet. Spread the mull as needed.

Chartæ *Papers*

Papers are preparations intended principally for external application, made either by saturating paper with medicinal substances or by applying the latter to the surface of the paper by the addition of some adhesive liquid. One paper is official in the N. F. (see Charta Potassii Nitratis, below).

CHARTA POTASSII NITRATIS. N. F. **Potassium Nitrate Paper**

[Chart. Pot. Nit.]

	Metric	**Old form**
Potassium Nitrate	**200 Gm.**	**7 oz. av. 24 gr.**
Water	**800 mils**	**27 fl. oz. 24 min.**

Dissolve the potassium nitrate in the water. Immerse strips of white, unsized paper in the solution, and dry them.

Keep the paper in well-closed containers.

QUESTIONS ON SOLID EXTEMPORANEOUS PREPARATIONS USED EXTERNALLY

What are cerates? (See page 1799.) Why are they so called?
How are cerates made?
How many cerates are official?
Give the formulas and official process for the following cerates:
Cerate—Give the Latin official name. What is the synonym?
Cantharides cerate—Give the Latin official name. Give the synonym.
Rosin cerate—Give the Latin official name. Give the synonym.
What are the ingredients in rosin cerate?
Camphor cerate—What is the formula?
Cerate of lead subacetate—Give the synonym. How is it prepared?
Compound rosin cerate—What is the synonym? Name the ingredients.
What are ointments? In what different ways are ointments made?
In making ointments by fusion, what precaution is necessary?
How may mechanical impurities be separated?
How are ointments made by incorporation?
What official ointment is made by chemical reaction?
What three maxims should be observed in making or dispensing ointments?
Give the formulas and modes of making the following ointments, viz.:
Ointment—Give the Latin official name. What is the synonym?
Ointment of boric acid—Give the Latin official name.
Ointment of tannic acid—Give the Latin official name.
Ointment of rose water—Give the Latin official name. If this ointment has been chilled, what treatment should it receive before incorporating other ingredients?
Belladonna ointment—Give the Latin official name.
Chrysarobin ointment—Give the Latin official name.
Diachylon ointment—Give the Latin official name.
Nutgall ointment—Give the Latin official name.
Mercurial ointment—Give the Latin official name.
What percentage of metallic mercury should mercurial ointment contain? How may it be assayed?
Ointment of ammoniated mercury—What is the Latin official name?
Blue ointment—What is the Latin official name? What is the P. I. title? What percentage of mercury should it contain?
Ointment of mercuric nitrate—Give the Latin official name. Give the synonym.
Ointment of yellow mercuric oxide—Give the Latin official name.
Iodine ointment—Give the Latin official name.
Iodoform ointment—Give the Latin official name.

Ointment of phenol—What is the Latin official title? What were the official Latin and English titles in the U. S. P. 1890?
Tar ointment—Give the Latin title.
Stramonium ointment—Give the Latin official name.
Sulphur ointment—Give the Latin name.
Ointment of zinc oxide—Give the Latin official name.
Give the Latin title, synonyms, if any, and important ingredients in the following N. F. ointments:
Calmine ointment; camphor ointment; brown ointment; ointment of red mercuric oxide; compound tar ointment; ointment of red lead; ointment of potassium iodide; compound resorcinol ointment; alkaline sulphur ointment; compound sulphur ointment; veratrine ointment; ointment of zinc stearate.
How may cerates and ointments be preserved from rancidity?
What kind of jars are the best receptacles for ointments?
What is the best-shaped jar for dispensing ointments?
How are collapsible tubes used for ointments? What are their advantages? How may they be quickly filled? How should they be labeled?
What sort of wooden boxes are best for ointments?
How may a neat finish be given to ointments in boxes?
What are inunctions? Name those official.
What are glycerogelatins? Name those official.
What are dermatologic pastes? Name those official in the N. F. and give their synonyms.
What are poultices? What is spice poultice?
How is cataplasm of kaolin made? What special precautions should be taken in making this product?
What are plasters?
What is the basis of most of the official plasters?
How may spread plasters be softened?
How many plasters are official?
Give the formulas and modes of making the following plasters, viz.:
Adhesive rosin plaster—Give the Latin official name.
Belladonna plaster—Give the Latin official name.
What percentage of mydriatic alkaloid should be present? How may it be assayed?
Capsicum plaster—Give the Latin official name.
Cantharides plaster—For what is it used?
Rubber plaster—What is the synonym?
Lead plaster—Give the Latin official name. Give the synonym.
How was this plaster made by the U. S. P. VIII?
Mustard plaster—Give the synonyms.
Camphorated brown plaster—Give the synonym.
Soap plaster—What is the Latin title?
Upon what substances are plasters usually spread?
What is the method of proceeding in spreading a plaster upon leather?
What advantage has a plaster-iron over a spatula for spreading plasters?
What advantage has a spatula over a plaster-iron?
How are blisters spread?
What is a good material upon which to spread them?
What are mulls? By what other names are they known?
How are they made? Name those official in the N. F.
What are chartæ or papers?
How many are official? How is potassium nitrate paper prepared?

CHAPTER LXIX

STERILIZATION AND AMPULS

The extensive use of sterile solutions, preparations and dressings in medical practice and the large application of the principles of sterilization to manufacturing processes, for the purpose of preserving products from decomposition, have made it desirable to include a brief consideration of this subject. The U. S. Pharmacopœia IX and the National Formulary IV have both added articles on sterilization; but the student should, at the very outset, be impressed with the importance of a thorough preliminary training in the technique of bacteriological practice, lest he become over-confident and attempt processes which require the most exacting care and training for their successful accomplishment. What is presented here is largely suggestive, and space cannot be taken for that intricate detail which is necessary. The student is therefore urged to secure laboratory training in general bacteriological methods before undertaking work along this line.

The pharmacist will also often handle sterile products, prepared in special laboratories, and it is important that he should know and always remember that they remain sterile only so long as they are properly protected from contamination. No wrappings should be removed, or seals broken, or containers opened until ready for use. The responsibility in dealing with this class of preparations is very heavy, as often life itself may depend upon the product being properly sterilized and then kept in that condition until used.

Portions of the U. S. P. and N. F. articles on sterilization are incorporated in the following:

The term Sterilization, as used in medical or pharmaceutical practice, means a process whereby the destruction or removal of all microscopic living organisms and their spores is accomplished. Some bacteria, under certain conditions, undergo a transformation into a resting stage, when they are called spores. In the spore state they are able to resist influences which would kill the bacteria. Most disease-producing bacteria do not form spores and are therefore comparatively easily killed. The anthrax and tetanus bacilli are exceptions to this, as their spores are quite resistant. An object which is free from living microörganisms is spoken of as being sterile," but this condition can be maintained only so long as the necessary precautions are taken to prevent contact with the atmosphere or other media or apparatus which may carry microörganisms.

The uses of sterilization, as applied by pharmacists, are:

1. For the preparation of solutions for hypodermic injection.
2. For the preparation of aseptic medicines for internal or external administration.
3. For the preparation of solutions, dressings, etc., for surgical use.
4. For the preservation of preparations or substances through the

destruction of organisms which would otherwise cause deterioration or decomposition.

There are various methods whereby sterilization may be accomplished, and it is necessary that the operator shall select in each case the one which is most suitable.

From the viewpoint of the pharmacist it is important to know:

First.—That most microörganisms multiply rapidly at temperatures between 20° and 40° C. (68° and 104° F.) if there is some nutritive material present.

Second.—If contaminated substances are maintained at a temperature of freezing (0° C. or 32° F.) or below, the development of organisms is retarded, but they are not necessarily destroyed.

Third.—All classes of microörganisms, whether they are bacteria, moulds, yeasts, diatoms or protozoa, also their spores, may be destroyed by practically the same procedure. Any method which will kill all bacterial spores will also destroy every form of life.

Fourth.—Bacteria may develop in almost any substance if sufficient moisture and atmospheric oxygen are present and the temperature is favorable. Some bacteria are anaërobic, that is, they do not require oxygen, and will not survive in its presence.

Yeasts develop in saccharine substances, while moulds develop within and upon a large variety of organic substances. Protozoa and diatoms may occur in water which is highly contaminated with organic matter. Bacteria and moulds do not thrive in sunlight, while diatoms and algæ generally develop best in sunlight.

Fifth.—Bottles, flasks, test tubes, etc., stoppered with purified cotton, then sterilized and kept dry, may be maintained in a sterile condition for an indefinite period. Before opening, however, the orifice should be sterilized by passing it through a Bunsen flame. The exterior of the cotton plug is burned off at the same time, thus destroying bacteria which may have lodged there.

Sixth.—It is desirable that the pharmacist should operate, while preparing sterilized solutions, ointments, etc., under conditions which will avoid the possibility of the contamination of the material, apparatus, etc., by the falling of dust during the operation.

Seventh.—Bottles containing sterilized liquids to be dispensed should be closed with rubber stoppers which have previously been sterilized by boiling for ten minutes in a 5 per cent. phenol solution, then thoroughly rinsed in boiling water and stored in alcohol until used. These should be handled only with large tweezers, the tips of which have been sterilized by heating in a Bunsen flame.

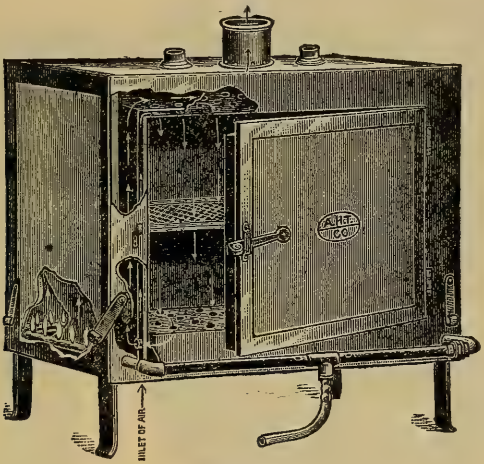
Eighth.—Sterilized freshly distilled water should be used in preparing all aqueous solutions. It should be prepared as follows: Place the necessary quantity of freshly distilled water in a flask of Jena or other so-called ''non-soluble'' glass, which has been previously cleansed and sterilized as described for glassware in Section B. Close the mouth of the flask with a pledget of sterilized purified cotton, boil the contents for thirty minutes, and allow it to cool without removing the cotton plug. Finally protect the mouth of the flask and the cotton stopper from infection with dust by wrapping it in sterilized paper. For use in hypodermic injections only freshly distilled water should be taken, and it should be used within forty-eight hours after sterilization (see *Aqua Destillata Sterilisata,* page 309).

The methods by which sterilization may be accomplished are as follows:

A. Direct Flame (Flaming).—It is sometimes possible to make use of the direct application of the Bunsen flame (see page 123) for sterilization, when the object will not be injured. Such objects as platinum needles, dry pipettes, the metallic orifice of a Berkefeld or similar filter, the lip of a bottle or test tube, the points of tweezers or forceps used for handling sterilized rubber stoppers, the walls of a metallic closet, etc., may be rapidly sterilized by holding them within the Bunsen flame or playing the flame over them a few times.

B. Dry Heat.—This method requires that the object be heated in an oven or suitable apparatus (see Fig. 368, page 264, and Fig. 810) at a temperature of from 160° to 170° C. (320°–338° F.) continued for at least two hours. It is desirable that the object be wrapped in paper so that it may be afterwards handled and stored in a sterile condition. Slight browning or charring of the paper is not objectionable, and is one of the indications that the proper temperature has been reached.

Fig. 810



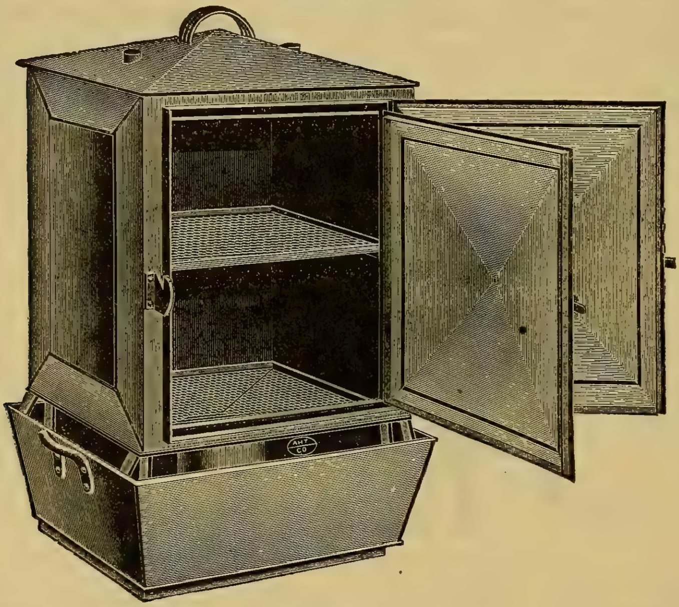
Dry Heat Sterilizer

This process may be used for the sterilization of empty bottles, funnels, test tubes, Petri dishes, ointment jars, and other glassware, but should not be used for any substance which may be injured by the high temperature required. Before exposing glassware to the heat of the sterilizer it should be dried.

This method may also be used for the sterilization of petrolatum, fixed oils, lard, and many powders as talc, kaolin, boric acid, zinc oxide, and others which are not injured by this temperature, the precaution being taken, however, to spread them out in a thin stratum, about 6 mm. (¼ inch) in thickness, so that the heat may penetrate.

In sterilizing petrolatum and fixed oils, apply the heat directly to a sand bath carrying the vessel containing the substance, raise the temperature of the oil to 200° C. (392° F.), and then immediately withdraw the heat and protect the sterilized product from contamination. Glycerin should not be heated higher than 150° C. (302° F.) and this temperature should be maintained for one-half hour. Volatile substances, such as Camphor Liniment, for example, should be placed in strong bottles, such as solution of magnesium citrate bottles, the stoppers fastened in, or in sealed ampuls, and the containers and contents heated in an oil bath or a concentrated, aqueous calcium chloride solution to a temperature of about 120° C. (248° F.) for one hour.

FIG. 811

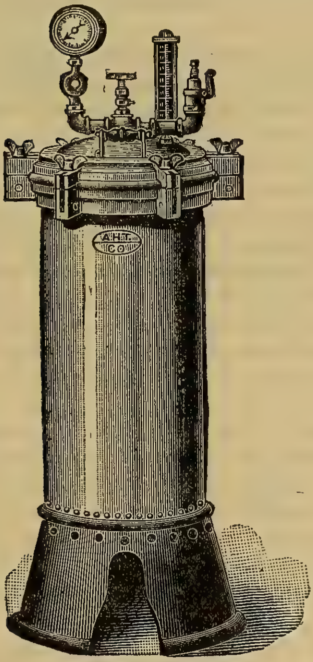


Arnold Steam Sterilizer

Bottles and other glassware which are to be sterilized should be thoroughly cleansed to remove all organic matter, afterwards rinsed with very weak hydrochloric acid (about 0.3 per cent.) to neutralize the alkalinity of the glass, then with distilled water until the washings are neutral and, after drying, stoppered with purified cotton, and finally wrapped in paper and heated for one hour at about 180° C. (356° F.).

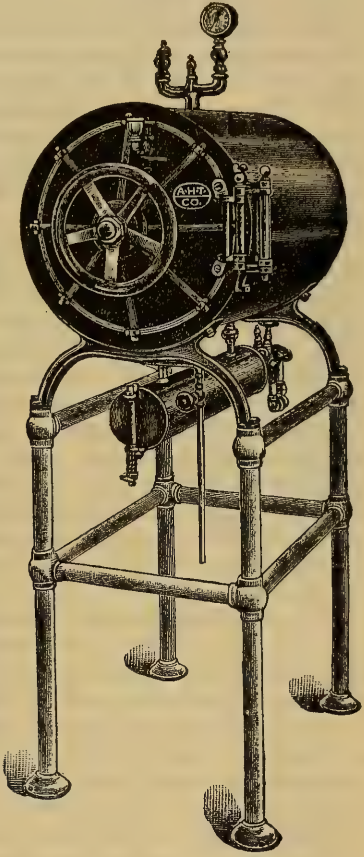
C. Moist Heat at 100° C. (212° F.).—The use of live steam for sterilization, usually in an Arnold sterilizer (see Fig. 811) or in a covered kettle or boiler, is more generally applicable than dry heat. On account of the greater penetrating power of steam than that of dry heat a lower temperature is equally efficient for sterilization. By this process the substance to be sterilized is sometimes heated but once in live steam, the treatment continuing for from thirty minutes to one hour, but ''interrupted'' or ''fractional'' sterilization is preferable, due to the fact that many substances are injured by prolonged heating, and especially because organisms may exist in the spore stage and in that condition will not be destroyed by the first heating. For the application of ''interrupted'' sterilization, the substance is heated in live steam, after the temperature has been raised to 100° C. (212° F.) for fifteen minutes each day on three successive days, the substance being kept during the resting period between the heatings at a temperature of about 20° C. (68° F.). The ''moist heat'' sterilization at 100° C. (212° F.) may be used for many pharmaceutical solutions, such as some eye waters, gargles, and similar solutions, some medicinal syrups, mucilages, etc. This method may also be used for the sterilization of collapsible metal tubes.

Fig. 812



Autoclave

Fig. 813



Autoclave

Much of the glassware on the market is relatively quite soluble in water. When solutions are sterilized in glass vessels of this character, a copious precipitate appears on cooling, together with a clouding of the glass, and in the sediment may be seen glistening spicules or thin flakes. It is therefore advisable to use vessels made of one of the varieties of glass known as "non-soluble."

The alkalinity of the glass should be neutralized as described under *B* and, if this has been done, this method may be used in sterilizing solutions for culture media, caffeine, caffeine salicylate, caffeine benzoate, sodium arsenate, sodium cacodylate and the mineral acid salts of strychnine, morphine and cocaine.

D. Steam Under Pressure.—For laboratory purposes this form of sterilization has many advantages. Its application by the use of a steam cylinder, known as an autoclave (see Figs. 812 and 813), produces results from one heating of fifteen minutes, under a pressure of one atmosphere (a temperature of about 115° C.) (239° F.), which are more reliable than the method requiring heating at 100° C. (212° F.) each day for three successive days. The higher temperature, however, must again be considered and the method cannot be used for substances which are injured by this degree of heat. The process is well adapted to the sterilization of solutions of stable salts, etc.

Surgical Dressings.—Cotton, bandages, gauzes, ligatures, etc., may be rendered sterile by treatment with steam in a pressure apparatus (autoclave) at 115° C. (239° F.) for fifteen minutes or by exposure to dry heat in an ordinary air-bath or sterilizer at a temperature of from 160° to 170° C. (320°–338° F.) for two hours. It should be remembered that all surgical materials are not amenable to such thorough treatment without more or less deterioration taking place. Bandages must be folded or packed in such a manner as to permit the penetration of steam or dry heat during the process and should be so arranged that after the sterilization is completed all subsequent contamination with bacteria will be prevented. This is usually accomplished by immediately enclosing them in glass containers or wrapping them in a number of thicknesses of previously sterilized parchment paper.

E. Low Temperature (Pasteurization).—This process is carried out in practically the same way as described under *C* [interrupted sterilization with moist heat at 100° C. (212° F.)], except that the temperature is maintained at from 60° to 70° C. (140°–158° F.).

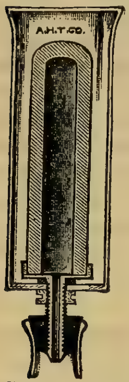
Material to be sterilized at pasteurization temperature is heated on six successive days for from one-half to one hour each day at the temperature indicated above, and during the resting stage between the heatings, kept at about 20° C. (68° F.).

This method is employed when the material to be sterilized is readily decomposed by heat, and it is recommended for the sterilization of solutions of organic salts, alkaloids, alkaloidal salts, and such other substances as are subject to decomposition by exposure to a higher temperature.

F. Filtration.—This method, when suitable apparatus is used, affords one of the most practical and efficient processes for preparing sterilized solutions. A Berkefeld or Chamberland filter candle, which is made of stone or porcelain, is so arranged that the orifice projects from the bottom of a glass or metallic cylinder, a metallic bell being attached above and around the outlet. To hasten the operation, the jar may be arranged so that it can be closed and air pressure applied over the liquid to be filtered. Pressure may be applied by a rubber bulb or hand pump through a tube fitted with a stopcock. When the pressure has been applied the stopcock may be closed and the filtration allowed to proceed.

To use this apparatus it is supported on a tripod or retort stand, the metallic orifice and inside of the bell cover sterilized by the direct application of the Bunsen flame; the lip and cotton stopper of the sterilized vessel also flamed, the cotton plug removed and the bottle slipped over the outlet from the filter. The liquid to be sterilized is then poured into the jar, the pressure applied, and when all of the liquid has filtered into the bottle, the latter is closed with a sterilized stopper.

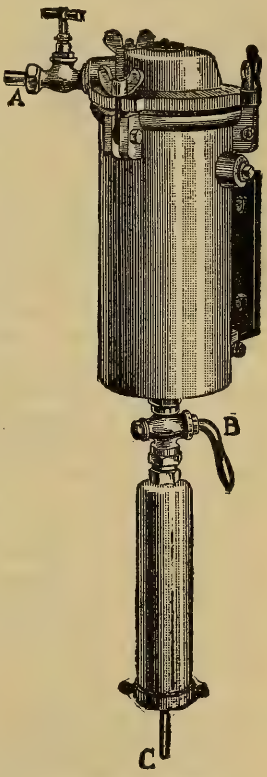
Fig. 814



Candle Filter.

The apparatus should be taken apart after each operation and the candle filter sterilized in an autoclave or by heating at 100° C. (212° F.) in live steam or boiling water, during one hour. It should be frequently tested by placing the entire candle under water and forcing air through it by means of a rubber bulb or a pump. By this means a break or crack is easily detected. Types of filter candles are shown in Figs. 814 and 815.

Fig. 815



Filtering Under Pressure

This device may be used, if the proper precautions are taken, for aqueous solution such as gargles, eye washes, solutions of alkaloids, etc.

G. Approximate Sterilization.—It may become desirable, when time is not available or when substances are easily injured by heat, to prepare solutions or preparations which are approximately sterile. If this method is to be used it is essential that distilled water, the several sizes of bottles, funnels, filter paper, rubber stoppers, ointment vehicles, ointment jars, collapsible metal tubes, etc., be kept on hand in a sterile condition.

The operator may conduct the necessary manipulation within a large sheet iron oven, the door of which is open and the interior of which has been sterilized with a Bunsen flame, or under a glass box which has been cleansed with alcohol and chloroform, or under a cloth canopy stretched on a wooden frame, the cloth immediately before use being moistened with 5 per cent. phenol solution. All weighings and operations should be carried out under the protected area. Weighings should be made on glass scale pans which have been first cleansed with alcohol and afterwards with chloroform, or on metallic pans which have been sterilized in a Bunsen flame. If a spatula is to be used it should be treated with alcohol and chloroform or passed through the Bunsen flame several times.

If an aqueous solution is to be prepared, the material is weighed and transferred to a sterilized bottle, the mouth of which has been sterilized in the flame before removing the cotton plug, the sterilized water is then added and the bottle stoppered with a sterilized stopper. Chemical salts and other substances which are likely to be used for making sterile preparations by this method should be procured especially for this work, and should be carefully protected from dust and other contamination. If a solution requires filtration, this can be done in the protected area, using a sterilized funnel and sterilized cotton or filter paper, which has been thoroughly washed with alcohol. Ointments, powders, etc., may be mixed within the protected space, using sterilized materials, apparatus, and containers. It must be remembered that this operation results in only approximate sterility, and that freedom from dust in the room, personal cleanliness of the operator, and the most scrupulous care throughout are required for satisfactory results.

This process is the one used in the preparation of Salvarsan or "606."

H. Sterilization by Means of Chemical Agents.—For the purpose of assisting in sterilization or of protecting substances from subsequent contamination, chemical agents are sometimes employed.

Dependence solely upon chemical germicides demands larger proportions of these than are usually allowable; hence they should be used as adjuncts only, and generally in quantities insufficient to insure sterility in themselves.

When chemical agents are employed, the usual precautions should be observed as to cleansing and sterilizing bottles, graduates, stoppers, etc., and in so far as possible without injury, the substance itself should be sterilized or pasteurized by heat. The chemical agents should only be used to assist in the processes and to hinder subsequent contamination.

This method is frequently used for:

1. The disinfection of the hands and the table before the preparation of a sterile solution.

2. For the disinfection of scale pans and spatula, etc., alcohol, ether, or chloroform being used chiefly for this purpose; but sterilization by heat is better.

3. To sterilize large glass vessels that cannot easily be subjected to heat—such as carboys, large bell jars, etc.

4. To maintain in a sterile condition various remedies such as antitoxins, bacterial vaccines, etc.

For the preservation of antitoxins and bacterial vaccines, phenol or cresol is used, the former in the proportion of 0.5 per cent., the latter from 0.25 per cent. to 0.4 per cent. Cresol is from two and a half to three times as strongly germicidal as phenol and scarcely more poisonous. While other chemical germicides may be used, these have been preferred because they are uniform and relatively non-toxic.

It is impossible to set definite limits which will fit all cases for the amounts of the chemical agents which may be employed, because the composition of the substance and its degree of contamination are important factors in sterilization.

Solutions of salts, practically free from organic matter, are easily sterilized, while solutions which contain appreciable, though small, amounts of organic substances may be difficult to sterilize.

Mineral acids, while objectionable as disinfectants in pharmaceutical preparations, inhibit the development of germs in very weak solutions, and acid solutions sterilize more easily than do neutral or slightly alkaline solutions.

Iodine is one of the most effective of disinfectants, and preparations containing free iodine in material proportions become sterile of themselves. The same is true of solutions containing chlorine or hypochlorites, or bromine. The chlorides, bromides, and iodides in general have only very feeble disinfecting power, but the soluble fluorides are active.

Chlorine and the hypochlorites, also bromine, have long been used as disinfectants; but because of their irritant properties their use was restricted. Now, however, various non-irritant chlorine compounds are being largely used in surgery, in the treatment of wounds, and in water sterilization (see Carrel-Dakin Solution, page 682, and Formulary Part VI, also Chlorazene, page 1010, and Halazone, page 1012).

The salts of mercury and of silver are active germicides and are among the most important disinfectants for physiological use, but they have specific actions which limit, or may prohibit, their addition to pharmaceuticals for antiseptic or disinfectant purposes. Salts of copper are powerful fungicides, but are feeble antiseptics. Other neutral salts are feebly antiseptic and not generally of value for this purpose.

Peroxides, when under conditions in which they liberate nascent oxygen, may sterilize, but are useful only in proportion to their own decomposition. Similar powers are attributed to persulphates and permanganates, which act by liberating nascent oxygen, and which require an intimate contact with the substance to be sterilized to be effective.

Of the organic bodies, alcohol stands first in pharmacy as a preservative. Alcohol, when present to the extent of from 20 to 40 per cent. by volume, is an efficient antiseptic. Solutions containing from 40 to 70 per cent. are actively disinfectant, the latter strength being most efficient. Above 70 per cent. its efficiency tends to diminish, and stronger alcohol may preserve without killing germs.

Formaldehyde is one of the most efficient of disinfectants, and is antiseptic in very small proportions, but may be objectionable for pharmaceutical preparations. Chloroform and bromoform are both active germicides in aqueous solutions, while iodoform is employed medicinally for this one purpose. Thymol iodide is another instance of like character.

Phenol is perhaps the most common of disinfectants, and with cresol is the substance most frequently used in hypodermatic and epidermatic medicaments. These have the advantage of combining activity with stability. Other phenolic compounds, as resorcinol, thymol, betanaphthol, phenyl salicylate (salol), etc., are useful agents and are frequently used in medication for their antiseptic qualities.

A number of the volatile oils, as anise, clove, cinnamon, pine, gaultheria, etc., possess appreciable value as antiseptics, and, while used mainly as flavors, are also employed for their antiseptic properties. Benzoic and salicylic acids are often preferred for internal administration. They are efficient as antiseptics, but are feeble as disinfectants. In foods these are limited to one part per thousand by food commissioners, which is not sufficient for sterilization, but which inhibits the development of most germs.

If the responsibility is thrown upon the pharmacist, the first consideration should be the character of the substance to be sterilized, the presence of antiseptic ingredients, whether active or feeble, being considered, and the action of heat upon it. Heat sterilization should always receive first consideration.

If pasteurization only is allowable, the use of 0.5 per cent. to 1 per cent. of phenol will aid materially in insuring sterility, since all germicides are much more efficient at high than at low temperatures. Cresol, in 0.1 to 0.4 per cent. solution, is also frequently used. These proportions may not be sufficient in themselves to produce sterility, but they are aids in securing and maintaining this condition, and are usually preferred in preparations for hypodermatic and epidermatic medication.

For medicines for internal administration hydrogen dioxide, sulphurous, salicylic or benzoic acid, or chloroform should be first considered. One part per thousand is the common limit for these, excepting hydrogen dioxide. The latter is often efficient in very small proportions (one in ten thousand), but is slow in action and of little value in mixtures or for preserving preparations used intermittently. It has the advantage of not seriously disturbing digestion.

The use of chemical disinfectants or antiseptics and the problems of sterilization call for judgment and some knowledge of the principles involved. No definite procedure can be recommended which will fit all cases. Success in sterilization must depend, as in other things, upon an intelligent application of principles rather than upon a literal following of arbitrary rules.

The use of the ultra-violet ray for the sterilization of water is also employed in large laboratories and hospitals. The water is passed through a special apparatus where it is exposed to the ultra-violet ray, which causes the destruction of all bacteria. An apparatus carrying one 110-volt lamp is capable of sterilizing 150 gallons of water per hour.

Pasteurizing Milk.—When milk is heated at low temperatures (between 50° and 80° C. or 122° and 176° F.) for from twenty to thirty minutes, most of the bacteria are destroyed without altering the nutritive quality of the milk. In many communities pasteurized milk may be obtained from milk dealers, but it may be readily prepared in the home by placing the milk in suitable bottles, usually the regular, round milk bottles used for infant feeding, holding from six to twelve fluidounces, stoppering them with absorbent cotton, placing them in a frame holding six or more bottles and this in a kettle of water. The water and milk are then heated to the desired temperature, usually between 65° and 70° C. (149°–158° F.), then allowed to stand, without further heating, for from twenty to thirty minutes, and afterwards quickly cooled. The milk should be kept in the bottles in which it was pasteurized, preferably on ice, until used.

Disinfectants.—In the prevention and treatment of diseases which are contagious or communicable, the modern practice of medicine has introduced the use of a number of substances which render inert or destroy the organisms which produce disease. The pharmacist will often be called upon for general information concerning the use and character of these substances and will be expected to supply them to the community. He should therefore be accurately informed concerning them; and, as there is not space in a book of this kind for its thorough treatment, attention is called to an excellent publication by the Public Health Service of the United States, *i.e.*, "Disinfectants, Their Use and Application in the Prevention of Communicable Diseases," by Thomas B. McClintic. This booklet may be obtained by writing to the Surgeon General at Washington, D. C.

Ampuls.—This is a term applied to small, flask-shaped glass containers holding various forms of sterilized medicinal solutions or suspensions, usually intended for injection, either intravenously, intramuscularly, or subcutaneously. The name is derived from the Latin *ampulla,* meaning flask.

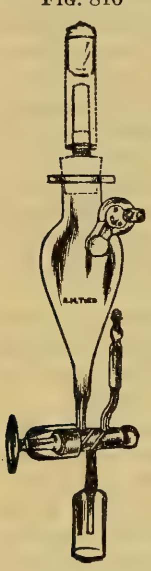
This form of medication has become popular in recent years, largely because of its convenience to the busy practitioner, the ease with which sterile products may be preserved and handled, and because of the prompt and direct response from medicinal agents.

Selecting the Empty Ampuls.—The first consideration is the containers. While these may be made by the pharmacist, when sufficiently skilled, from glass tubing, the better plan is to buy them from regular glass blowers. The kind of glass from which they are made is, however, of great importance. Common flint or bottle glass, or even the usual glass for chemical apparatus, is too soluble and alkaline for many substances. They should be made of a colorless, so-called "hard" or "non-soluble" glass. Amber glass is not well suited as it is exceptionally soluble. If protection from light is required, this may be secured by enclosing the filled ampuls in suitable boxes. The empty ampuls should be thoroughly cleaned by washing in distilled water, drained until dry, then sterilized by heating in a dry heat-sterilizer or oven for one hour, at about 180° C. (356° F.), and carefully protected from dust until filled and sealed.

Filling Ampuls.—Many ingenious devices have been offered for filling ampuls. One general plan calls for the inversion of fifty or more empty sterile ampuls in a sterilized jar, the pouring on top of them of just sufficient of the sterile solution to fill the ampuls, then the creation of a vacuum in the jar and ampuls by means of a suction pump, followed by the slow admission of air through a cotton filter. The air pressure forces the solution into the ampuls, which may then be quickly sealed.

Another plan is illustrated in Fig. 816. Here the solution is sterilized by filtration through a candle filter located at the top of the apparatus, and is received in the sterilized glass reservoir below. By turning the stopcock the amount for each ampul may be measured in the graduated cylinder on the side, and by another turn of the stopcock the liquid is delivered into the ampul below, which is subsequently sealed. This apparatus is expensive, difficult to sterilize, and very slow in operation. Machines are being automatically operated on a large scale whereby sterile ampuls are filled, individually, as each passes a certain point on the outer edge of a revolving disk. At this point a syringe, similar to a hypodermic syringe, delivers the measured volume of sterile solution inside the ampul. As the disk revolves another empty ampul moves into position for filling, while the filled ampul is sealed, then removed, and its place taken by a fresh empty ampul. The pharmacist, however, is not likely to equip himself with elaborate apparatus for doing this work, especially when a burette having a glass stopcock and with a small glass tip attached to the lower orifice will be found very satisfactory for filling ampuls. Having sterilized the empty ampuls, the burette, and the solution or suspension, and set up the apparatus in a protected area where it is not likely to be contaminated by falling or floating dust, the ampuls may be readily filled. The glass tip should be plunged inside the ampul to a point below the neck, so that the air may escape and the neck remain dry for sealing. When filled, the ampul is sealed by holding it in a Bunsen burner at an angle, so that the contents do not run into the neck of the flask, and slowly rotating it continuously, so that as the glass melts it tends to turn inward, sealing the neck with a bead of glass. If available, a blast lamp is to be preferred for the sealing, as non-soluble glass melts slowly in the Bunsen flame. In whatever manner it has been filled, it is best to sterilize the sealed ampul again to insure a perfect product.

FIG. 816



Filling Ampuls

Sterilizing Ampuls.—The method to be followed in sterilizing the empty glass ampuls has already been given. Delicate glass apparatus, used in filing ampuls, must be sterilized with great care, especially avoiding sudden changes of temperature. It must be heated and cooled slowly, whether sterilized in an autoclave or with dry heat. It is not possible to outline specific directions for sterilizing the solutions to be filled into ampuls, as they must be given individual consideration. Some substances are not injured by even the heat of the dry air sterilizer, while others are destroyed by 100° C. (212° F.) and therefore must be pasteurized. Often the alkalinity of the glass used for making ampuls is a contributing factor in decomposition. Substances, reported sensitive to heat, may often be successfully sterilized at the higher temperatures if contained in non-soluble glass when, under the influence of alkalies from soluble glass, they would have been quickly destroyed.

When ampuls have been filled and sealed for the final sterilization, if the autoclave temperature and pressure are permissible, that is always preferred and may be easily secured for the pharmacist by heating the sealed ampuls for fifteen minutes in a boiling saturated solution of ammonium chloride. This solution boils at about 115° C. (239° F.), and thus provides the usual autoclave conditions within the ampuls. It is customary to color the solution blue so that a leaking ampul will quickly be discovered through its contents becoming colored. The saturated solution should not be boiled actively as the ampuls are thereby subjected to needless danger from breakage. If temperatures lower than 115° C. (239° F.) are necessary, the process already outlined for live steam at 100° C. (212° F.) either continuous or interrupted, may be used, or, if required, the interrupted pasteurization method may be followed. The more important substances sold in ampuls and the temperature and process for sterilization are given in the following table:

Substance in solution or suspension to be sterilized	Process	Temperature
Argyrol	Steam heat	100° C.
Atropine Sulphate	Low heat or filtration	60°–70° C.
Caffeine and Sodium Benzoate	Low heat or filtration	60°–70° C.
Calomel in oil (5 per cent.)	Steam heat	100° C.
Camphorated Oil (10 per cent.) in ampuls	Autoclave or steam heat	115° C. or 100° C.
Cocaine Hydrochloride	Low heat or filtration	60°–70° C.
Emetine Hydrochloride	Steam heat	100° C.
Ergot (aqueous solution)	Low heat or filtration	60°–70° C.
Eucaine Hydrochloride	Low heat or filtration	60°–70° C.
Grey Oil (It must not be heated)	Extinguish the mercury in sterile oil, using a sterile mortar	
Iron Arsenite	Steam heat	100° C
Iron Arsenite with Ammonium Citrate	Steam heat	100° C.
Iron Arsenite with Strychnine	Steam heat	100° C.
Iron Cacodylate	Low heat or filtration	60°–70° C.
Iron and Ammonium Citrate	Steam heat	100° C.
Mercury Benzoate	Steam heat	100° C.
Mercury Cacodylate	Steam heat	100° C.
Mercury Salicylate	Steam heat	100° C.
Morphine Hydrochloride	Steam heat	100° C.
Morphine Sulphate	Steam heat	100° C.
Morphine and Atropine	Low heat or filtration	60°–70° C.
Pilocarpine Nitrate	Low heat or filtration	60°–70° C.
Quinine Dihydrochloride	Steam heat	100° C.
Quinine and Urea Hydrochloride	Steam heat	100° C.
Salvarsan	Approximate sterilization (see page 1841)	No heat
Sodium Cacodylate	Steam heat	100° C.
Stovaine	Steam heat	100° C.
Strychnine Nitrate	Steam heat	100° C.
Strychnine Sulphate	Steam heat	100° C.

QUESTIONS ON STERILIZATION AND AMPULS

Why is this subject important? (See page 1835.)
What cautions should be observed and why?
How may the principles of sterilization be applied by the pharmacist?
What important facts should the pharmacist understand about these operations?
Outline the methods for applying "direct flame" sterilization and its applications.
What are the temperatures for "dry heat sterilization"? How may it be applied, and what are its applications?
Describe the sterilizing of bottles, of petrolatum, of powders.
How is sterilization with moist heat applied?
What are its uses?
Name the advantages of using steam under pressure for sterilizing. What temperature and pressure is usually used? Describe an autoclave.
How may surgical dressings be sterilized?

What is meant by "pasteurization"? How is it carried out? What is the temperature used?
Why must this method be used for some substances?
What is meant by "interrupted sterilization"?
How may solutions be sterilized by filtration?
What precautions are necessary to insure sterile solutions by this method?
What is meant by "approximate sterilization"?
Describe the method for its application.
For what important substance must this method be used?
How may substances be sterilized by chemical agents? What are the most important uses for this method?
Mention the various chemicals available for this purpose and their uses and limitations.
What are disinfectants? Why should the pharmacist familiarize himself with the more important disinfectants?
How may milk be pasteurized? What temperature is used? What is the advantage of pasteurized milk?
What are ampuls? Why are ampuls of value?
What kind of glass should be used in making ampuls? Why?
How may ampuls be filled? How sealed?
Describe the various methods of sterilization which may be used in sterilizing the empty ampuls, the filling apparatus, the solution or substance to be placed in the ampul, and the final sterilization of the filled and sealed ampul.
Give the temperatures and methods by which some of the more important substances may be sterilized.

PART VI

FORMULARY OF UNOFFICIAL PREPARATIONS

THE following formulas have been collected principally with the view of saving the labor and time of the pharmacist, who is often suddenly called upon to prepare some remedy for which he may not have a formula in his recipe book. The author's name is appended to the formula when it is known, and the selection has been carefully made so as to embrace many which are not easy of access. The subjects are arranged alphabetically, using the English title, and appending the Latin title whenever one has been adopted; it is believed that this will facilitate ready reference to any formula.

Acetic Acid, Camphorated

Camphor,	1 oz. av.
Acetic Acid,	16 fl. oz.

Powder the camphor with the aid of alcohol, and dissolve it in the acetic acid.

Analgesic Balm

Lanolin,	675 grains
Yellow Wax,	150 grains
Distilled Water,	225 grains
Menthol,	225 grains
Methyl Salicylate,	225 grains

Aromatic and Antacid Corrective of Indigestion

(Dr. J. J. Levick)

Sodium Bicarbonate,	80	grains
Compound Tincture of Cardamom,	4	fl. dr.
Compound Infusion of Gentian,	2½	fl. oz.
Peppermint Water,	3	fl. oz.

Mix. A tablespoonful as required.

Aromatic Antiseptic Solution

(Eye Wash, Hoffman)

Camphor,	8	grains
Thymol,	8	grains
Sodium Chloride,	83	grains
Sodium Benzoate,	83	grains
Sodium Bicarbonate,	170	grains
Oil of Spearmint,	8	grains
Oil of Eucalyptus,	13½	grains
Oil of Dwarf Pine Needles,	13½	grains
Alcohol,	154	grains
Glycerin,	417	grains
Water, a sufficient quantity,		
To make	32	fl. oz.

Brassicon

Camphor,	20 grains
Oil of Peppermint,	1 fl. dr.
Volatile Oil of Mustard,	12 minims
Ether,	2 fl. dr.
Alcohol,	6 fl. dr.
Spirit of Peppermint, sufficient to color.	

Mix. Used externally in headache.

Bromo-Chloralum

Aluminum Chloride,	1 oz. troy
Aluminum Bromide,	240 grains
Boiling Water,	8 fl. oz.

Dissolve by heat on a water bath; when cool, filter through paper.

Camphor, Phenolated

Camphor,	60 grains
Phenol,	20 grains
Alcohol,	2 minims

Mix.

Camphor Julep

(Thomsonian name)

Camphor,	30 grains
Myrrh,	105 grains
Sugar,	60 grains
Water,	2 fl. oz.

Caustic, Iodine

(Rieseberg's)

Iodine,	1 oz. troy
Glycerin,	2 fl. oz.

Applied every second day with a brush. As the preparation is very powerful, its effect must be watched.

Caustic, Painless

(Esmarch's)

Arsenic Trioxide,	2 grains
Morphine Sulphate,	2 grains
Mild Mercurous Chloride,	16 grains
Powdered Acacia,	96 grains

Mix.

Cerate of Lead, Compound

(J. Parrish, Sr.)

Cerate of Lead Subacetate,	240 grains
Cerate,	240 grains
Powdered Opium,	60 grains
Mild Mercurous Chloride,	60 grains

Mix. Used in eruptions of a local character.

Cerate, Savine

CERATUM SABINÆ. U. S. 1880

	By measure
Fluidextract of Savine, 25 parts, or	5 oz. av.
Resin Cerate, 90 parts, or	18 oz. av.

Melt the resin cerate by means of a water bath, add the fluidextract of savine, and continue the heat until the alcohol has evaporated; then remove the heat, and stir constantly until cool.

Cerate, Soap

CERATUM SAPONIS. U. S. 1870

Soap Plaster,	2 oz. troy
Yellow Wax,	2½ oz. troy
Olive Oil,	4 oz. troy

Melt together the plaster and wax, add the oil, and, after continuing the heat a few minutes, stir the mixture until cool.

Cerate of Zinc Carbonate

Precipitated Zinc Carbonate,	2 oz. troy
Ointment,	10 oz. troy

Mix them thoroughly.

Chloroform, Gelatinized

Purified Chloroform,	6 fl. dr.
White of Egg,	6 fl. dr.

Put into a wide-mouthed, two-ounce vial, shake it, and allow it to stand for three hours.

Cleanser, Non-explosive Gasoline

I

Benzene,	4 parts
Carbon Tetrachloride,	6 parts

Mix.

or

II

Benzene,	1 part
Carbon Tetrachloride,	9 parts

Mix.

Collodion for Corns

(Gezow's)

Salicylic Acid,	45 grains
Extract of Indian Hemp,	8 grains
Collodion,	6 fl. dr.

Dissolve.

Collodion, Corn, Liebig's

Salicylic Acid,	5 grains
Extract of Indian Hemp,	30 grains
Collodion,	5 fl. dr.

Mix and dissolve.

Collodion, Hemostatic

(Pavesi's)

Tannic Acid,	80 grains
Benzoic Acid,	45 grains
Phenol,	158 minims
Collodion,	3½ fl. oz.

Mix and dissolve.

Collodion, Iodinal

(J. T. Shinn's)

Iodine,	120 grains
Canada Turpentine,	2 fl. dr.
Collodion,	8 fl. oz.

Dissolve the iodine and turpentine in the collodion. Used as a substitute for Iodine Ointment.

Cologne, Headache

Menthol,	77 grains
Perfumed Spirit, N. F. IV (Cologne Water),	3 fl. oz.

Colors for Show Bottles

Dark Blue

Copper Sulphate,	240 grains
Water,	2 gal.
Ammonia Water, sufficient.	

Dissolve the copper salt in water, add ammonia water until the precipitate first formed is just redissolved, and then introduce the remainder of the water.

Dark Green

Copper Sulphate,	8 oz. av.
Potassium Dichromate,	60 grains
Water,	16 pints

Mix and filter.

Red

Fuchsin,	20 grains
Acetic Acid,	2 fl. oz.
Water,	8 pints

Mix.

Yellow

Potassium Dichromate,	4 oz. av.
Nitric Acid,	4 fl. oz.
Water,	16 pints

Mix and filter.

Confection, Aromatic

CONFECTIO AROMATICA. U. S. 1870

Aromatic Powder,	4 oz. troy
Clarified Honey,	4 oz. troy

Rub the aromatic powder with clarified honey until a uniform mass of the proper consistence is obtained.

Confection of Black Pepper

(Ward's Paste)

Black Pepper,	2 oz. troy
Powdered Inula,	2 oz. troy
Powdered Fennel,	6 oz. troy
Honey,	4 fl. oz.
Sugar,	4 oz. troy

Rub the dry ingredients together into a very fine powder, and keep them in a covered vessel; but, whenever the confection is to be used, add the powder gradually to the honey, and beat them until thoroughly incorporated. Dose, 60 to 120 grains three times a day.

Confection, Laxative

Potassium Bitartrate,	240 grains
Powdered Jalap,	240 grains
Confection of Senna,	1 oz. troy

Make into a mass, using syrup of ginger if too hard. Dose, a drachm three times daily.

Confection of Opium

CONFECTIO OPII. U. S. 1870

Opium, in fine powder,	270 grains
Aromatic Powder,	6 oz. troy
Clarified Honey,	14 oz. troy

Rub the opium with the aromatic powder, then add the honey and beat the whole together until thoroughly mixed.

Confection of Orange Peel

CONFECTIO AURANTII CORTICIS. U. S. 1870

Sweet Orange Peel, recently separated from the fruit by grating,	6 oz. troy
Sugar,	18 oz. troy

Beat the orange peel with the sugar, gradually added, until they are thoroughly mixed.

Confection of Rhubarb, Compound

(Chelsea Pensioner)

Rhubarb,	120 grains
Powdered Guaiac,	60 grains
Potassium Bitartrate,	1 oz. troy
Sulphur,	2 oz. troy
Powdered Nutmeg,	60 grains
Honey,	10 fl. oz.

Make into a confection.

Conserve of Hollyhock

(Thomsonian Name)

Poplar Bark,	120 grains
Bayberry,	120 grains
Hydrastis,	120 grains
Cloves,	120 grains
Cinnamon,	120 grains
Cypripedium,	120 grains
Capsicum,	60 grains
Oil of Pennyroyal,	1 fl. dr.
Hollyhock Flowers,	4 oz. troy

Pound, and form into small balls.

Cotton, Boric Acid

Purified Cotton Wool, sufficient.	
Boric Acid,	60 grains
Water,	9 fl. dr.

Dissolve the boric acid in the water at a temperature of 60° C. (140° F.); saturate the purified cotton with this solution, press it, dry it, and preserve in wide-mouth, cork-stoppered vials.

Cotton, Iodized

Iodine,	60 grains
Purified Cotton,	1½ fl. oz.

Enclose the iodine in filtering paper, and place it at the bottom of a flask with a wide mouth; then introduce the cotton, and close the flask by covering the mouth. Place the flask in a moderately warm place until the cotton appears to be uniformly colored by the iodine.

Cotton, Iodoform

Purified Cotton,	360 grains
Iodoform,	24 grains
Ether,	2 fl. dr.
Alcohol,	4 fl. dr.
Glycerin,	2 fl. dr.

Dissolve the iodoform in the ether and alcohol mixed, add the glycerin to this solution, and saturate the cotton with this liquid. Let it dry by exposure to the air.

Cotton, Salicylic Acid

Purified Cotton,	600 grains
Salicylic Acid,	60 grains
Alcohol,	10 fl. dr.
Glycerin,	6 minims

Dissolve the salicylic acid in the alcohol, add the glycerin to this solution, and saturate the cotton with the liquid; press out the superfluous liquid, and dry.

Cream of Camphor

Castile Soap, dry and grated,	120 grains
Ammonium Carbonate (*fresh*),	120 grains
Powdered Camphor,	120 grains
Oil of Thyme,	1 fl. dr.
Oil of Turpentine,	2 fl. oz.
Tincture of Opium,	2 fl. dr.
Water, a sufficient quantity,	
To make	1 pint

Dissolve the soap and the ammonium carbonate in 10 fl. oz. of hot water and pour in a pint bottle. Dissolve the camphor in the mixed oils, add to the soap solution, shaking the mixture. Add the tincture of opium and sufficient water to make 1 pint.

Cream for Chilblains

(Vance's)

Ointment of Mercuric Nitrate,	1 oz. troy
Camphor,	60 grains
Oil of Turpentine,	2 fl. dr.
Olive Oil,	4 fl. dr.

Mix well. To be applied with gentle friction before the chilblains break.

Cream, Chloral

Hydrated Chloral,	300 grains
Sugar,	1½ oz. troy
Water,	15 fl. dr.

Dissolve the hydrated chloral in the water, and triturate with the sugar in a mortar.

Cream, Cucumber

White Wax,	9 oz.
Oil,	24 oz.
Benzoic Acid,	15 grains
Cucumber Juice,	10 oz.

Mix as directed for ointment of rose water, the juice taking the place of the water.

Cream, Rolling

Skimmed Milk,	4 fl. oz.
Alum,	75 grains
Sodium Borate,	40 grains
Boric Acid,	26 grains
Liquefied Phenol,	1 drop
Cochineal Solution,	1 drop
Perfume as desired.	
Water, a sufficient quantity.	

Warm the milk in a flask to about 54.4° C. (130° F.), dissolve the sodium borate and boric acid in 300 minims of water in a test tube with the aid of heat and add it to the milk solution. Then dissolve the alum in 240 minims of hot water, add one-half of the solution to the milk mixture, mix, and if it does not curdle, separating a clear liquid, add more of the alum solution until it does curdle. Then collect the casein on a straining cloth, work it with water until the washings are tasteless, allow it to drain, press it firmly in the cloth and transfer the moist magma to a dish. Rub this until smooth, add the phenol, cochineal solution, and perfume and mix. Preserve in a tightly closed container.

Cream, Cold (Theatrical)

I

Snow White Mineral Jelly,	8 ℔
White Wax,	2 ℔
Sodium Borate,	1½ oz.
Water,	1 gal.
Perfume as desired.	

Prepare in a manner similar to that directed for the official Ointment of Rose Water.

II

White Wax,	5 oz. av.	3 grains
Liquid Petrolatum,	20 fl. oz.	384 grains
Water,	7 fl. oz.	326 grains
Sodium Borate,		140 grains
Perfume as desired,		
To make about	33 oz. av.	

Prepare in a manner similar to that directed for the official Ointment of Rose Water.

Cream, Vanishing

Monohydrated Sodium Carbonate,	60 grains
Sodium Borate,	840 grains
Glycerin,	960 grains
Stearic Acid (highest grade),	1920 grains
Distilled Water,	35 fl. oz.
To make	33 oz. av.

Dissolve the sodium borate and monohydrated sodium carbonate in the glycerin and water which have been previously heated on a water bath, in a tared dish. Introduce the stearic acid very slowly in a granular form, constantly stirring. Continue the heat until the reaction is complete and the preparation is reduced to 33 oz. av. Then remove it from the bath and stir or beat it continuously until it has become firm. The desired perfume can then be added. The stearic acid must be of the purest grade and all ingredients should be of the best.

Dakin's Oil

(Chlorinated Oil Chlorinated Eucalyptol)

A non-irritating, germicidal solution of *dichloramin T* (*toluene-parasulphondichloramin*) in chlorinated eucalyptol or a mixture of chlorinated eucalyptol and chlorinated liquid petrolatum. For nasal and throat treatment a 2 per cent. solution of dichloramin T in one part of chlorinated eucalyptol and four parts of chlorinated liquid petrolatum has been recommended. For the treatment of wounds a five to seven and one-half per cent. solution in chlorinated eucalyptol has given excellent results, replacing the Carrel-Dakin solution to advantage, as it may be used in from thirty to forty times the strength of the latter solution and apparently does not produce skin irritation.

"Dichloramin T" may be prepared by treating toluene parasulphonamid with an aqueous solution of calcium hypochlorite, acidifying with acetic acid, extracting the dichloramin with chloroform and evaporating to obtain the product. It is, however, a commercial product, manufactured by the Abbott Laboratories, and should be purchased by the pharmacist.

The *chlorinated eucalyptol* was selected because it serves as a solvent for the dichloramin T and may be applied to wounds. It is prepared by treating 500 mils of U. S. P. eucalyptol with 15 Gm. of potassium chlorate and 50 mils of U. S. P. hydrochloric acid, allowing it to stand for twelve hours, then washing well with an aqueous solution of sodium carbonate, and afterwards adding dry sodium carbonate and allowing it to stand for twenty-four hours. The product is finally filtered and dried with a little calcium chloride. A 10 per cent. solution of dichloramin T is relatively permanent when dissolved in chlorinated eucalyptol.

For nasal and throat treatment a vehicle of greater viscosity is desired and, to meet this need, the addition of *chlorinated liquid petrolatum* has been proposed. While dichloramin T is not soluble in this vehicle, limited amounts may be added to the solution of dichloramin T in chlorinated eucalyptol. It is prepared as follows: Add 15 Gm. of potassium chlorate and 50 mils of U. S. P. hydrochloric acid to 500 mils of liquid petrolatum, expose the mixture to the light and allow it to stand for twenty-four hours. Then wash it thoroughly, in a separatory funnel, alternately with water and sodium bicarbonate solution. Draw off the opalescent oil, add calcium chloride and 5 Gm. of charcoal, and filter the mixture, using a suction pump. (See *J. A. M. A.*, July 7, 1917, vol. lxix, page 27.)

Decoction of Barley

Decoctum Hordei. U. S. 1870

Barley,	240 grains
Water, sufficient.	

Having washed away extraneous matters which adhere to the barley, boil it with 2 fl. oz. of water for a short time, and throw away the resulting liquid; then, having poured on it 16 fl. oz. of boiling water, boil down to 8 fl. oz., and strain.

Decoction, Zimmerman's

Rhubarb,	30 grains
Potassium Bitartrate,	240 grains
Barley,	240 grains
Water,	16 fl. oz.

Boil for fifteen or twenty minutes, strain, and add enough simple syrup or sugar to sweeten the decoction.

Dip, Sheep

I

Soap,	1 ℔ av.
Crude Carbolic Acid,	16 fl. oz.
Water,	100 quarts

Dissolve the soap in a gallon or more of boiling water, add the acid, and stir thoroughly. Any kind of soap may be used. Keep the mixture well thinned in using, and do not let it get into the eyes, mouth, or nostrils of the sheep.

II

Mix 25 pounds av. of sulphur with 12½ pounds av. of good lime. Triturate the mixture with water to a smooth cream and transfer this to a boiler of 20 gallons capacity. Make up the volume with water to 20 gallons, boil and stir during half an hour, when the liquid should have a dark red color. If yellowish, continue the boiling until the dark red color is obtained, keeping the volume at 20 gallons. When the liquid has cooled decant off any small quantity of insoluble residue and make up the volume to 100 gallons with water.

Draught, Effervescing

Potassium Bicarbonate,	80 grains
Water,	2 fl. oz.

Make a solution. Take a tablespoonful of lemon juice diluted with a tablespoonful of water, and add to it in a tumbler a tablespoonful of this solution, then drink immediately.

Drops, Bishop or Cardinal

(Tinctura Episcopalis)

Orange Peel,	720 grains
Orange Berries,	720 grains
Cloves,	120 grains
Cinnamon,	120 grains
Water,	3 fl. oz.
Bitter Almond Water,	2 fl. dr.
Alcohol,	12 fl. oz.

Mix, and macerate seven days.

Drops, Red

(Whitwith's)

Oil of Thyme,	2 fl. dr.
Tincture of Myrrh,	1 fl. oz.
Tincture of Camphor,	1 fl. dr.
Compound Tincture of Lavender,	1 fl. oz.
Alcohol,	4 fl. oz.

Dose, 25 drops in a suitable vehicle, two, three, or four times a day.

Electuary, Tamarind

(Fuller's)

Sugar,	300 grains
Manna,	1¼ oz. troy
Tamarind,	210 grains
Potassium Bitartrate,	30 grains
Powdered Senna,	120 grains
Boiling Water,	3 fl. oz.

Dissolve the sugar and manna in the boiling water, and filter, then add the other ingredients.

Elixir of Chloroform

(Dr. Hartshorn's Chloroform Paregoric)

Chloroform,	1½	fl. oz.
Tincture of Opium,	1½	fl. oz.
Spirit of Camphor,	1½	fl. oz.
Aromatic Spirit of Ammonia,	1½	fl. oz.
Oil of Cinnamon,	20	minims
Brandy,	2	fl. oz.

Mix. Dose, one-half fl. dr. or less.

Elixir of Chloroform

Chloroform,	6	fl. dr.
Oil of Cinnamon,	10	minims
Tincture of Opium,		
Tincture of Camphor,		
Aromatic Spirit of Ammonia, of each,	6	fl. dr.
Brandy,	1	fl. oz.

Mix. Dose, half a teaspoonful.

Elixir Clauderi

Potassium Carbonate,	240	grains
Aloes,	60	grains
Guaiac,	60	grains
Myrrh,	60	grains
Saffron,	60	grains
Rhubarb,	60	grains
Water,	9	fl. oz.

Macerate a few days, and decant. Dose, a tablespoonful.

Elixir, Digestive, Compound

(N. F. III)

Pepsin,	150	grains
Pancreatin,	15	grains
Diastase,	15	grains
Lactic Acid,	8	grains
Hydrochloric Acid,	15	minims
Glycerin,	8	fl. oz.
Water,	4	fl. oz.
Tincture Cudbear,	½	fl. oz.
Purified Talc,	½	troy oz.
Aromatic Elixir, a sufficient quantity,		
To make	32	fl. oz.

Mix the acids with the glycerin and the water, add the pepsin, pancreatin, and diastase to this mixture, and macerate with occasional shaking, until solution is apparently effected. Then add the cudbear and enough aromatic elixir to make 32 fl. oz. Incorporate talc and filter.

Elixir Four Chlorides

Corrosive Mercuric Chloride,	⅓	grain
Solution of Arsenous Acid,	32	minims
Tincture Ferric Chloride,	138	minims
Diluted Hydrochloric Acid,	138	minims
Syrup,	406	minims
Aromatic Elixir,	1 fl. oz. 7	minims
Water, a sufficient quantity,		
To make	3 fl. oz. 183	minims

Elixir Iron, Quinine, and Strychnine Phosphates

(George M. Beringer)

Soluble Ferric Phosphate,	255	grains
Quinine,	128	grains
Strychnine,	4	grains
Phosphoric Acid,	31	minims
Alcohol,	6 fl. oz. 192	minims
Glycerin,	6 fl. oz. 192	minims
Compound Spirit of Orange,	154	minims
Purified Talc,	1	oz. av.
Ammonia Water,		
Distilled Water, each, a sufficient quantity,		
To make	32	fl. oz.

Dissolve the quinine and strychnine in the alcohol, add the compound spirit of orange, then the glycerin, and afterwards the phosphoric acid, previously diluted with 6 fl. oz. 192 minims of water. Dissolve the soluble ferric phosphate in 6 fl. oz. 192 minims of warm distilled water, and gradually add this solution, with continual stirring to the alcoholic solution. Now add ammonia drop by drop, until the mixture becomes clear and is neutral, being careful to avoid an excess of ammonia, then add sufficient distilled water to make the product measure 32 fl. oz. Mix the talc and filter and preserve in amber-colored bottles.

Elixir Iron, Quinine and Strychnine Phosphates

(Charles Caspari, Jr.)

Soluble Ferric Phosphate,	255	grains
Quinine,	128	grains
Strychnine,	4	grains
Phosphoric Acid,	31	minims
Ammonium Carbonate,	75	grains
Alcohol,	1 fl. oz. 442	minims
Acetic Acid,	234	grains
Distilled Water,		
Aromatic Elixir, each, a sufficient quantity,		
To make	32	fl. oz.

Add the ammonium carbonate to the acetic acid contained in a suitable vessel and when solution is complete, add sufficient distilled water to make 1 fl. oz. 288 minims. To this solution add 11 fl. oz. 96 minims of aromatic elixir and then the phosphoric acid. Dissolve the quinine and strychnine in 1 fl. oz. 134 minims of alcohol, add this solution to the previous mixture, and rinse the container with the remaining alcohol. Now add sufficient aromatic elixir to measure 28 fl. oz. 77 minims. Dissolve the ferric phosphate in 461 minims of water by the aid of heat, and add aromatic elixir up to 3 fl. oz. 403 minims. Finally, mix the two solutions and filter, if necessary. Keep the finished product in amber-colored bottles.

Note.—If the ferric phosphate is very acid, add ammonia water cautiously until it is nearly but not entirely neutral.

Elixir of Paraldehyde

Paraldehyde,	160	minims
Alcohol,	14	fl. dr.
Tincture of Vanilla,	30	minims
Water,	1	fl. oz.
Syrup,	1½	fl. oz.

Dose, 1 to 2 teaspoonfuls.

Emulsion of Aspidium

Fluidextract of Aspidium,	1	fl. dr.
Tincture of Quillaja,	30	minims
Distilled Water, sufficient,		
To make	1	fl. oz.

Mix.

Emulsion of Cod Liver Oil, Pancreatic

Cod Liver Oil,	3	fl. oz.
Powdered Pancreatin,	60	grains
Syrup,	1	fl. oz.

Digest at a moderate heat. The emulsion is miscible with water, and may be given in chocolate, milk, or coffee.

Emulsion of Cod Liver Oil with Calcium Hypophosphite

Cod Liver Oil,	8 fl. oz.
Powdered Acacia,	2 oz. av.
Calcium Hypophosphite,	128 grains
Water,	4 fl. oz.

Place the powdered acacia in a dry mortar, add the cod liver oil, and rub until smooth. Dissolve the calcium hypophosphite in the water, and add all at once to the above, rubbing until a perfect emulsion is formed; then add sufficient water to make 16 fl. oz.

Emulsion of Cod Liver Oil with Hypophosphite of Calcium and Sodium

Calcium Hypophosphite,	128 grains
Sodium Hypophosphite,	96 grains
Powdered Acacia,	2 oz. av.
Cod Liver Oil,	8 fl. oz.
Water,	4 fl. oz.

Place the powdered acacia in a dry mortar, add the cod liver oil, and rub until smooth. Dissolve the hypophosphites in the water, and add all at once to the above mixture, rubbing until a perfect emulsion is formed; then add sufficient water to make 16 fl. oz.

Emulsion of Cod Liver Oil with Phosphate of Calcium and Sodium

Calcium Phosphate,	256 grains
Sodium Phosphate,	64 grains
Acacia,	2 oz. av.
Hydrochloric Acid,	128 minims
Cod Liver Oil,	8 fl. oz.
Water,	4 fl. oz.

Place the powdered acacia in a dry mortar, add the cod liver oil, and rub until smooth. Dissolve the phosphates in the water by the aid of the acid, and add all at once to the above mixture, rubbing until a perfect emulsion is formed; then add sufficient water to make 16 fl. oz.

Emulsion of Cubeb

Oleoresin of Cubeb,	120 drops
Yolk of Egg,	1
Sugar,	120 grains
Peppermint Water,	3 fl. oz.

Triturate the oleoresin with the sugar and yolk of egg, and then dilute with peppermint water. Dose, a teaspoonful four times a day.

Emulsion of Guaiac

Guaiac (powdered),	12 grains
Tincture of Quillaja,	1 fl. dr.
Distilled Water,	1 fl. oz.

Dissolve the guaiac in the tincture, filter, and then mix with the water.

Emulsion of Pumpkin Seed

Pumpkin Seed (fresh),	2 oz. av.
Powdered Acacia,	60 grains
Sugar,	240 grains
Water,	4 fl. oz.

Blanch the seeds, after soaking them in hot water, beat them into a mass with the sugar, then add the acacia, and gradually the water.

Emulsion, Phosphatic

Cod Liver Oil,	8 fl. oz.
Glycerite of Yolk of Egg,	5 fl. oz.
Diluted Phosphoric Acid,	1½ fl. oz.
Oil of Bitter Almond,	25 minims
Jamaica Rum,	8 fl. oz.
Orange Flower Water, a sufficient quantity,	
To make	32 fl. oz.

To the glycerite of egg in a bottle add the cod liver oil in successive portions, emulsifying after each addition, by shaking. Then add the phosphoric acid, rum, and oil of bitter almond, and incorporate thoroughly. Finally add enough orange flower water to make 32 fl. oz.

Emulsion, Silver Iodide (5 per cent.)

Potassium Iodide,	50 grains
Silver Nitrate,	48½ grains
Mucilage of Acacia (10 per cent.), a sufficient quantity,	
To make	3 fl. oz.

Dissolve the potassium iodide and silver nitrate each separately in 1½ fl. oz. of the mucilage of acacia. Pour the silver nitrate solution into the potassium iodide solution slowly and with constant stirring. **Note.**—Other mucilages may be used if preferred, such as mucilage of Irish moss, quince seed, or tragacanth and solution of gelatin has also been recommended.

Emulsion, Terraline

Terraline,	4 fl. oz.
Whisky,	1 fl. oz.
Jamaica Rum,	1 fl. oz.
Water,	2 fl. oz.
Sugar, granulated,	½ oz. troy
Acacia, powdered,	1 oz. troy

Use the English method in making this emulsion. It has been suggested to previously warm the mortar and also the terraline before proceeding with the process.

Essence of Vanillin, Compound

Vanillin,	90 grains
Coumarin,	6 grains
Alcohol,	6 fl. oz.
Glycerin,	4 fl. oz.
Syrup,	4 fl. oz.
Compound Tincture Cudbear,	½ fl. oz.
Water, a sufficient quantity,	
To make	32 fl. oz.

Eupod and Eusol

The powder, to which the name "Eupod" has been applied, is prepared by mixing equal parts of boric acid and chlorinated lime, by trituration, and sifting the mixture through a No. 60 sieve.

To prepare "Eusol" add 365 grains of the mixed powders (Eupod) to 32 fl. oz. of distilled water, agitate thoroughly and filter after standing two hours.

Extract of Mezereum

Extractum Mezerei. U. S. 1880

Mezereum, in No. 30 powder, 100 parts, or	16 oz. av.
Alcohol, a sufficient quantity.	

Moisten the powder with 40 parts [or 6 fl. oz.] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding alcohol, until 300 parts [or 3 pints] of tincture are obtained, or the mezereum is exhausted. Reserve the first 90 parts [or 13 fl. oz.] of the percolate; evaporate the remainder, at a temperature not exceeding 50° C. (122° F.) to 10 parts [or 2 fl. oz.]; mix this with the reserved portion, and evaporate, at or below the before mentioned temperature, in a porcelain capsule, on a water bath, to a pilular consistence.

Eyewash of Sodium Borate

Sodium Borate,	4 grains
Camphor Water,	1 fl. oz.

Mix.

Eye-water

(Thomas's)

Zinc Sulphate,	20 grains
Sodium Chloride,	20 grains
Rose Water,	1 fl. oz.

Mix.

Floor Dressing

Liquid Petrolatum,	8 pints
Neatsfoot Oil,	4 pints
Cotton Seed Oil,	6 pints
Kerosene,	2 pints
Oil of Lavender,	1 fl. oz.
Oil of Sassafras,	3 fl. oz.

Mix.

Fluid, Muller's

Potassium Dichromate,	200 grains
Sodium Sulphate,	80 grains
Water,	16 fl. oz.

Fluidextract of Lactucarium

Extractum Lactucarii Fluidum. U. S. 1880

Lactucarium, in coarse pieces, 100 Gm., or	12½ oz. av.
Ether, 100 Gm., or	1 pint
Alcohol,	
Water, each, a sufficient quantity,	
To make 100 mils, or	12 fl. oz.

Add the lactucarium to the ether contained in a tared flask having the capacity of 600 mils [or about 4½ pints], and let it macerate for twenty-four hours; then add 300 Gm. [or 2¼ pints] of water, and shake the mixture well. Fit a bent glass tube into the neck of the flask, and, having immersed the flask in hot water, recover the ether by distillation. When all the ether has distilled over, remove the tube, and, after thoroughly shaking the contents of the flask, continue the heat for half an hour. Let the mixture cool, add 100 Gm. [or 14½ fl. oz.] of alcohol, and enough water to make the whole mixture weigh 500 Gm. [or 64 oz. av.]; after maceration for twenty-four hours, with occasional agitation, express and filter the liquid. Return the dregs to the flask and macerate them with 200 Gm. [or 28 fl. oz.] of a mixture of alcohol and water made in the proportion of 1 part [or 8 fl. oz.] of alcohol to 3 parts [or 20 fl. oz.] of water; repeat the maceration two or three times, successively, with fresh portions of the mixture, until the dregs are tasteless, or nearly so. Mix, and filter the liquids thus obtained, and concentrate them, by means of a water bath (the first expressed liquid by itself), until the combined weight of the liquids is 60 Gm. [or 7½ oz. av.]; mix the liquids, add 40 Gm. [or 6 fl. oz.] of alcohol, and let the mixture cool in the evaporating vessel, stirring the mixture frequently, and during the intervals keeping the vessel well covered. When cool, add enough alcohol to make the mixture weigh 100 Gm. [or 12½ oz. av.], transfer the liquid to a flask, and add enough water to make the mixture measure 100 mils [or 12 fl. oz.], using the water so required to rinse the evaporating vessel. Shake the mixture occasionally, during several hours (and frequently, if a portion of the precipitate is found to be tenacious), and, when a uniform mixture results, set it aside for twenty-four hours, so that any precipitate formed may subside. Decant the clear liquid, transfer the precipitate to a filter, and, after thoroughly draining it into the decanted liquid, wash it with a mixture of alcohol and water made in the proportion of 3 parts [or 10 fl. dr.] of alcohol to 4 parts [or 11 fl. dr.] of water, until the washings pass tasteless. Concentrate the washings, by evaporation, to a syrupy consistence, mix with the decanted liquid, and add enough of the last-named mixture of alcohol and water to make the whole measure 100 mils [or 12 fl. oz.]. Lastly, after twenty-four hours, having meanwhile shaken the fluidextract occasionally, filter it through paper.

Formalin Antiseptic

Cinnamic Acid,		9 grains
Benzoic Acid,		30 grains
Boric Acid,		170 grains
Thymol,		30 grains
Menthol,		30 grains
Oil of Dwarf Pine Needles,		13 minims
Oil of Eucalyptus,		26 minims
Tincture of Myrrh,		26 minims
Solution of Formaldehyde,		123 minims
Acetic Ether,		13 minims
Glycerin,	1 fl. oz.,	299 minims
Alcohol,	4 fl. oz.,	108 minims
Water, a sufficient quantity,		
To make		8 pints

Gargle of Alum

Alum,	120 grains
Honey,	1 fl. oz.
Infusion of Flaxseed,	3 fl. oz.

Make a gargle.

Gauze, Corrosive Sublimate

Corrosive Mercuric Chloride,	2 grains
Glycerin,	50 minims
Water,	1 fl. oz.

Immerse bleached absorbent muslin in this solution for about twelve hours; then wring it out, and allow it to dry as far as the glycerin will permit.

Gauze, Eucalyptus

(Lister's)

Oil of Eucalyptus,	60 minims
Damar,	180 grains
Paraffin,	180 grains

The damar and paraffin are melted, the oil is added, and the mixture sprinkled or squirted over the muslin laid together in folds. It is then placed in an air-tight heating apparatus, compressed by weights, and exposed to a dry heat. The finished gauze contains 10 to 11 per cent. of mixture.

Glycerin, Iodized

Iodized Oil of Bitter Almond,	1 fl. dr.
Glycerin,	7 fl. dr.

Mix. See Iodized Oil of Bitter Almond, page 1861.

Glycerite of Birch Tar

Birch Tar,	1 oz. troy
Glycerin,	8 fl. oz.

Dilute the glycerin with one-fifth of its volume of water, and mix.

Glycerite of Borax

Glyceritum Sodii Boratis. U. S. 1870

Sodium Borate,	2 oz. troy
Glycerin,	8 fl. oz.

Rub them together in a mortar until the Sodium Borate is dissolved.

Glycerite of Gallic Acid

Glyceritum Acidi Gallici. U. S. 1870

Gallic Acid,	2 oz. troy
Glycerin,	8 fl. oz.

Rub them together in a mortar, then transfer to a glass or porcelain capsule, and heat gently until the acid is dissolved.

Glycerole of Bismuth Nitrate

Bismuth Nitrate (Cryst),	120 grains
Glycerin,	1 fl. oz.

Dissolve the bismuth nitrate in the glycerin, without heat.

Glycerole of Chloral and Camphor

(C. Pavesi)

Camphor (in powder),	75 grains
Hydrated Chloral,	60 grains
Oil of Juniper,	30 minims
Glycerin,	4 fl. dr.
Alcohol,	5 fl. dr.

Mix in a vial, and expose to a gentle heat (not over 40° C. = 104° F.) until solution has been effected. Let cool, and keep the vial well stoppered.

Glycerole of Lead Subacetate

(Dr. Balmanno Squire)

Lead Acetate,	1 oz. troy
Lead Oxide,	336 grains
Glycerin,	4 fl. oz.

Mix, and expose for some time to a temperature of 176.6° C. (350° F.). Filter through paper in a hot water funnel.

Hemostatic, Pavesi's

Sulphocarbolic Acid,	3 fl. dr.
Benzoic Acid,	37 grains
Tannic Acid,	37 grains
Alcohol,	3 fl. dr.
Glycerin,	3 fl. dr.
Rose Water,	3 fl. oz.

The sulphocarbolic acid is prepared by mixing 1 part sulphuric acid and ½ part phenol and heating for a few minutes on a water bath; the benzoic acid is dissolved in the alcohol and glycerin, the tannic acid in the water, and both mixed.

Household Ammonia

Detergent Solution of Ammonia

Stronger Ammonia Water,	10 fl. oz.
Oleic Acid,	2 fl. oz.
Alcohol,	2 fl. oz.
Distilled Water, a sufficient quantity,	
To make	32 fl. oz.

About 5 per cent. of borax may be added if desired, and a little oil of lavender or other suitable perfume.

Infusion of Catechu, Compound

Infusum Catechu Compositum. U. S. 1870

Catechu, in fine powder,	240 grains
Cinnamon, in moderately fine powder,	60 grains
Boiling Water,	16 fl. oz.

Macerate in a covered vessel, and strain.

Infusion of Flaxseed, Compound

Infusum Lini Compositum. U. S. 1870

Flaxseed,	½ oz. troy
Glycyrrhiza (bruised),	120 grains
Boiling Water,	16 fl. oz.

Macerate for two hours in a covered vessel, and strain.

Infusion of Myrrh, Compound

Myrrh,	23 grains
Aloes,	23 grains
Saffron,	23 grains
Potassium Carbonate,	15 grains
Powdered Extract of Glycyrrhiza,	120 grains
Water,	6 fl. oz.
Compound Tincture of Cardamom,	2 fl. oz.

Boil slowly to 4 fl. oz., strain, and add the compound tincture of cardamom.

Infusion of Tar. Tar Water

Infusum Picis Liquidæ. U. S. 1870

Tar,	4 oz. troy
Water,	16 fl. oz.

Mix them, and shake the mixture frequently during twenty-four hours; then pour off the infusion, and filter through paper.

Inhalation, Bromin

(Nettolitzky's)

Bromine,	16 grains
Potassium Bromide,	16 grains
Distilled Water,	7 fl. oz.

Dissolve. To be poured, a small quantity at a time, upon a sponge or lint for inhalation in croup.

Inhalation, Thymol

(Warren)

Thymol,	8 grains
Sodium Borate,	300 grains
Glycerin,	10 fl. dr.
Camphor Water,	2½ fl. oz.
Tar Water,	7 fl. oz.

Mix. To be used as an inhalation by means of an atomizer.

Ink, Black

Tannic Acid,	60 grains
Gallic Acid,	13½ grains
Iron Sulphate,	54 grains
Acacia,	17 grains
Dilute Hydrochloric Acid,	55 minims
Liquefied Phenol,	2 minims
Distilled Water, a sufficient quantity,	
To make	4 fl. oz.

Ink, Red

I

Eosin,	1 part
Acacia,	2 parts
Water,	97 parts

Dissolve the dye in water and in this solution dissolve the acacia.

II

Brazil Wood,	1 oz.
Tin. Chloride,	15 grains
Dextrin,	30 grains
Boiling Distilled Water,	1 pint

Insecticides

See Farmers' Bulletin No. 127, U. S. Department of Agriculture.

Iodine, Camphorated Chloro-tannate of

Hydrated Chloral,	60 grains
Iodine,	30 grains
Oil of Camphor,	6 fl. dr.
Tannic Acid, sufficient.	

Dissolve, and add sufficient tannic acid to bring the mixture to the consistence of thick syrup.

Iodine, Carbolate of

(Dr. Holtz's formula)

Phenol (Cryst.),	60 grains
Alcohol,	1 fl. dr.
Tincture of Iodine,	4 fl. dr.
Water,	5 fl. dr.

Mix.

Iodoform, Carbolized

Iodoform,	150 grains
Phenol,	1 minim
Oil of Peppermint,	2 minims

Mix the iodoform and phenol by trituration, and then add the volatile oil.

Jelly, Castor Oil

Castor Oil,	3 fl. oz., 21 minims
Stearic Acid,	38 grains
Sodium Hydroxide (U. S. P.),	9 grains
Saccharin,	1½ grains
Oil of Peppermint,	3 minims
Alcohol,	81 minims

Dissolve the sodium hydroxide in the alcohol, add the castor oil and stearic acid, heat until combined, add the other ingredients and then cool.

Lemonade Iron

(Goodell's)

Tincture of Ferric Chloride,	2 fl. dr.
Diluted Phosphoric Acid,	6 fl. dr.
Spirit of Lemon,	2 fl. dr.
Syrup, sufficient,	
To make	6 fl. oz.

Mix. A dessertspoonful in water after meals.

Liniment of Aconite

LINIMENTUM ACONITI. U. S. 1870

Aconite, in fine powder,	8 oz. troy
Glycerin,	1 fl. oz.
Alcohol, a sufficient quantity.	

Moisten the powder with 4 fl. oz. of alcohol, and let it macerate for twenty-four hours, then pack in a conical percolator, and gradually pour alcohol upon it until 2 pints of tincture have been obtained. Distil off a pint and a half of alcohol, and evaporate the remainder until it measures 7 fl. oz.; to this add the glycerin, and mix them thoroughly.

Liniment, Arnica

Arnica Flowers,	2 oz. av.
Glycerin,	8 fl. oz.

Digest at a moderate temperature on a water bath, express, and strain.

Liniment, Cantharides

LINIMENTUM CANTHARIDIS. U. S. 1880

Cantharides, in No. 60 powder, 15 parts, or	1 oz. av.
Oil of Turpentine, a sufficient quantity, or	8 fl. oz.
To make 100 parts, or	½ pint.

Digest the cantharides with 100 parts [or ½ pint] of oil of turpentine, in a closed vessel, by means of a water bath, for 3 hours; then strain and add enough oil of turpentine through the strainer to make the liniment weigh 100 parts [or measure ½ pint].

Liniment, Croup

Camphor,	320 grains
Oil of Turpentine,	2 fl. oz.

Make a solution.

Liniment, Fever

(Saint Barthelemy's)

Oil of Turpentine,	34 fl. dr.
Tincture of Opium,	80 minims
Camphor,	50 grains
Olive Oil,	2 fl. oz.

Mix. Apply for six minutes every six hours to the whole spine.

Liniment of Hypericum

RED OIL

Flowers of Hypericum (fresh),	8 oz. troy
Olive Oil, a sufficient quantity to cover the flowers.	

Macerate in the sun for fourteen days, express, and strain.

Liniment of Potassium Iodide

Soap,	420 grains
Potassium Iodide,	360 grains
Oil of Lavender,	15 minims
Alcohol,	4 fl. oz.
Water,	6 fl. dr.

Dissolve the soap in the alcohol by means of a gentle heat, and filter it if it is not perfectly transparent; then add the oil and the potassium iodide dissolved in the water; mix, and bottle it while warm.

Liniment of Iodoform

Iodoform,	80 grains
Camphor,	80 grains
Oil of Sassafras,	1 fl. dr.
Expressed Oil of Almond,	4 fl. oz.

Powder the iodoform and camphor, introduce into a dry vial, add the oils, and heat in a water bath, shaking frequently until dissolved.

Liniment of Mercury

Liniment of Camphor,	1 fl. oz.
Tincture of Quillaja,	3 fl. oz.
Stronger Ammonia Water,	160 minims
Water,	140 minims
Mercurial Ointment,	1 oz. troy

Mix.

Liniment of Lead Subacetate

LINIMENTUM PLUMBI SUBACETATIS. U. S. 1880

Solution of Lead Subacetate, 40 parts, or	2 oz. av.
Cotton Seed Oil, 60 parts, or	3 oz. av.
To make 100 parts, or	5 oz. av.

Mix them.

Liniment of Stillingia

Oil of Stillingia,	1 fl. oz.
Oil of Cajuput,	4 fl. dr.
Oil of Lobelia,	2 fl. dr.
Alcohol,	2 fl. oz.

Mix. Use as a local application in croup, and as a cough medicine, in doses of 1 drop on a lump of sugar.

Lobelia, Brown

The Thomsonian name for the seed.

Lobelia, Green

The Thomsonian name for the *herb*.

Lotion, Benzoin

Tincture of Benzoin,	40 minims
Rose Water, a sufficient quantity,	
To make	3 fl. oz.

Place the tincture in a dry bottle and add the water in a thin stream, or add the tincture to the water without mixing and slowly rotate the bottle.

Lotion, Calamine

I

(Dr. Tilbury Fox's)

Levigated Calamine,	40 grains
Zinc Oxide,	20 grains
Glycerin,	20 minims
Rose Water,	1 fl. oz.

Mix.

II

(Dr. L. D. Bulkley's)

Calamine,	62 grains
Zinc Oxide,	123 grains
Glycerin,	185 grains
Lime Water,	243 minims
Rose Water, or Water, a sufficient quantity,	
To make	4 fl. oz.

Lotion, Green Soap

(Hebra's)

Green Soap,	240 grains
Oil of Lavender,	15 minims
Boiling Water,	8 fl. oz.

Mix.

Lotion, Palmer's

Corrosive Mercuric Chloride,	4 grains
Alum,	6 grains
Water,	8 fl. oz.

Dissolve. For external use.

Lotion for Sore Nipples

(Dr. Atlee's)

Sodium Borate,	60 grains
Acacia,	120 grains
Tincture of Myrrh,	2 fl. dr.
Rose Water,	2 fl. oz.

Dissolve the Borate in the Rose Water; make a thick mucilage with the Acacia, and emulsify the tincture of myrrh; then add the rest of the solution.

Lotion for Sore Nipples

(Dr. Thomas's)

Alum,	1 oz. troy
Tincture of Galls,	1 fl. oz.

Triturate together, and dispense without straining or filtering.

Lotion, White

(Lotio Alba)

Zinc Sulphate,	5 Gm.
Sulphurated Potassa,	5 Gm.
Distilled Water or Rose Water, sufficient,	
To make	125 mils

Dissolve the salts each separately in 60 mils of distilled water or rose water, filter each solution, and slowly pour the zinc solution into the potassa solution. Finally add enough distilled water or rose water to make 125 mils.

Lozenges, Ammonia

(Dr. Jackson's)

Ammonium Chloride,	90 grains
Morphine Hydrochloride,	3 grains
Powdered Elm,	360 grains
Powdered Acacia,	420 grains
Powdered Sugar,	420 grains
Powdered Extract of Glycyrrhiza,	420 grains
Oil of Sassafras,	4 minims
Tincture of Tolu,	3 fl. dr.

To be made with syrup into 180 lozenges, or into lozenges of 10 grains each, containing ½ grain of ammonium chloride and $^1/_{60}$ grain of morphine hydrochloride.

Lozenges, Cough

(Keating's)

Lactucarium,	120 grains
Ipecac,	60 grains
Squill,	45 grains
Extract of Glycyrrhiza,	120 grains
Sugar,	2 oz. troy

Mix. Make into a mass with tragacanth and mucilage, and divide into 20-grain lozenges.

Lozenges, Pectoral

(Dr. Jackson's)

Powdered Ipecac,	5 grains
Sulphurated Antimony,	2½ grains
Morphine Hydrochloride,	3 grains
Powdered Acacia,	330 grains
Powdered Sugar,	330 grains
Powdered Extract of Glycyrrhiza,	330 grains
Oil of Sassafras,	2 minims
Tincture of Tolu,	2 minims

To be made into a stiff mass with simple syrup, and divided into 100 lozenges, or into lozenges of 10 grains each. Each lozenge contains $^1/_{20}$ grain of ipecac, $^1/_{40}$ grain of antimony, $^1/_{33}$ grain of morphine. One every three or four hours.

Mastisol, Wound Dressing

Mastic,	200 parts
Colophony,	100 parts
Venice Turpentine,	70 parts
Linseed Oil,	5 parts
Methyl Salicylate,	1 part
Benzol,	500 parts

Mixture, Acetone

(Dr. W. L. Atlee)

Acetone,	1 fl. dr.
Camphorated Tincture of Opium,	1 fl. oz.
Wine of Antimony,	1 fl. oz.
Wine of Tar,	2 fl. oz.

Mix. Dose, a teaspoonful.

Mixture, Alcoholic

(Gubler's)

Alcohol (85 per cent.),	
Water,	
Syrup of Orange, of each,	2 fl. oz.

A tablespoonful to be given every two hours.

Mixture, Alkaline Copaiba

Copaiba,	4 fl. dr.
Acacia,	240 grains
Sugar,	240 grains
Solution of Potassium Hydroxide,	4 fl. dr.
Spearmint Water, a sufficient quantity,	
To make	8 fl. oz.

Mix the capaiba and solution of potassium hydroxide; add the water, and triturate with the acacia and sugar.

Mixture, Antimonial and Saline

(Prof. Gross's)

Antimony and Potassium Tartrate,	2½ grains
Magnesium Sulphate,	2 oz. troy
Morphine Sulphate,	1⅓ grains
Aromatic Sulphuric Acid,	30 minims
Tincture of Veratrum Viride,	90 minims
Syrup of Ginger,	2 fl. oz.
Distilled Water,	10 fl. oz.

Mix. Average dose, a tablespoonful; to be diminished in case of vomiting or much nausea.

Mixture, Antispasmodic

(Sydenham's)

Tincture of Valerian,	5 fl. dr.
Compound Spirit of Ether,	1 fl. dr.
Tincture of Castor,	10 fl. dr.
Fennel Water,	12½ fl. oz.

Mix. Dose, a tablespoonful every three or four hours.

Mixture of Apium, Compound

(Dr. W. A. Hammond's)

Fluidextract of Erythroxylon	2 fl. oz.
Fluidextract of Viburnum,	1 fl. oz.
Fluidextract of Celery,	1 fl. oz.

Mix.

Mixture, Asthma

(Fothergill's)

Ammonium Iodide,	120 grains
Ammonium Bromide,	180 grains
Syrup of Tolu,	3 fl. oz.
Tincture of Lobelia,	5 fl. oz.

Mix. Teaspoonful every one, two, three, or four hours.

Mixture, Benzoated Alkaline

(Dr. Ellwood Wilson)

Potassium Bicarbonate,	90 grains
Benzoic Acid,	30 grains
Syrup of Orange,	4 fl. dr.
Water,	2½ fl. oz.

Rub the solids with 4 fl. dr. of water until effervescence ceases, then add the rest of the water, filter, and add the syrup. Dose, a tablespoonful three times a day after meals.

Mixture, Bottle Capping

Gelatin,	1 oz. av.
Acacia,	1 oz. av.
Starch,	1 oz. av.
Boric Acid,	20 grains
Water,	16 fl. oz.

Mix the acacia, gelatin, and acid with 14 oz. of cold water, and stir occasionally until the acacia is dissolved; then heat the mixture to boiling on a water bath, so that the gelatin dissolves; remove the scum and strain; mix the starch intimately with the remainder of the water and add this mixture to the hot gelatin solution, stirring until a uniform mixture results.

Mixture, Brandy

Yolk of Eggs,	2
Sugar,	240 grains
Oil of Cinnamon,	2 minims
Cinnamon Water,	4 fl. oz.
Brandy,	4 fl. oz.

Mix. Dose, a tablespoonful as occasion may require.

Mixture, Brown-Sequard's Anti-Epileptic

Sodium Bromide,	180 grains
Potassium Bromide,	180 grains
Ammonium Bromide,	180 grains
Potassium Iodide,	90 grains
Ammonium Iodide,	90 grains
Ammonium Carbonate,	60 grains
Tincture of Calumba,	1½ fl. oz.
Water, sufficient,	
To make	8 fl. oz.

Mix. Adult dose, 1½ teaspoonfuls before each meal, and 3 teaspoonfuls at bedtime.

Mixture, Subcarbonate Bismuth

Bismuth Subcarbonate,	120 grains
Cinnamon Water,	2 fl. oz.
Syrup of Acacia,	2 fl. oz.

Mix them. A teaspoonful for infants in cholera infantum.

Mixture, Ammonium Carbonate

Ammonium Carbonate,	90 grains
Powdered Acacia,	90 grains
Sugar,	90 grains
Aromatic Spirit of Ammonia,	2 fl. dr.
Compound Tincture of Cardamom,	2 fl. dr.
Water,	3½ fl. oz.

Mix. A tablespoonful every two or three hours.

Mixture, Chalk

(Richard's)

Precipitated Calcium Carbonate,	1 oz. troy
Sugar,	1 oz. troy
Tincture of Opium,	1 fl. dr.
Spirit of Cinnamon,	15 minims
Compound Tincture of Lavender,	1 fl. oz.
Tincture of Kino,	1 fl. oz.
Water,	3 fl. oz.

Mix.

Mixture, Charcoal and Blue Mass

Sodium Bicarbonate,	30 grains
Charcoal,	60 grains
Mass of Mercury,	8 grains
Aromatic Syrup of Rhubarb,	2 fl. oz.
Water,	2 fl. oz.

Triturate together into a uniform mixture. Dose, a tablespoonful.

Mixture, Cough

(Prof. Pancoast)

Wild Cherry Bark,	240 grains
Senega,	240 grains
Ipecac,	120 grains
Extract of Conium,	15 grains
Compound Tincture of Cardamom,	1 fl. oz.
Compound Spirit of Juniper,	1 fl. oz.
Water, sufficient,	
To make	10 fl. oz.

Percolate the solid ingredients with sufficient water to make 8 fl. oz., then add the other ingredients. Two teaspoonfuls in water constitute the usual dose to relieve cough.

Mixture, Cubeb

(Dr. J. Wm. White's)

Oleoresin of Cubeb,	4 fl. dr.
Potassium Bromide,	1 oz. troy
Syrup of Acacia,	2 fl. oz.
Oil of Sassafras,	10 minims
Water, sufficient,	
To make	6 fl. oz.

Mix.

Mixture, Diarrhœa

(Dr. Wm. Gould)

Compound Tincture of Rhubarb,	1 fl. oz.
Tincture of Opium,	4 fl. dr.
Spirit of Camphor,	2 fl. dr.
Ammonia Water,	1 fl. dr.
Oil of Peppermint,	30 minims

Mix. Dose, a teaspoonful in hot, sweetened water. Repeat as often as necessary till relieved.

Mixture of Gentian and Iron

(Meigs's)

Iron and Ammonium Citrate,	60 grains
Sugar,	1½ oz. troy
Fluidextract of Gentian,	30 minims
Compound Tincture of Lavender,	1 fl. oz.
Alcohol,	4 fl. dr.
Water, sufficient,	
To make	8 fl. oz.

Mix the Fluidextract with 1 fl. oz. of water and add the compound tincture of lavender; treat this with ferric hydroxide, and, having filtered it, mix with the other ingredients, and filter.

Mixture, Gout

(Laville's)

Quinine Sulphate,	30 grains
Cinchonine Sulphate,	22 grains
Extract of Colocynth,	195 grains
Diluted Alcohol,	3 fl. oz.
Red Wine, sufficient,	
To make	16 fl. oz.

Mix.

Mixture, Gout

(Scudamore's)

Magnesium Sulphate,	240 grains
Magnesium Oxide,	80 grains
Vinegar of Colchicum,	4 fl. dr.
Syrup of Saffron,	4 fl. dr.
Peppermint Water,	5 fl. oz.

Mix. Dose, 1 to 3 tablespoonfuls every two hours till four to six evacuations are produced in twenty-four hours.

Mixture, Hydrobromic Acid Cough

(Dr. J. Milner Fothergill's)

Spirit of Chloroform, B. P.,	40 minims
Hydrobromic Acid (Diluted),	60 minims
Syrup of Squill,	2 fl. dr.
Water, sufficient,	
To make	2 fl. oz.

Mix. Dose for an adult, a tablespoonful.

Mixture of Iron and Conium

(Dr. King's Am. Disp.)

Precipitated Carbonate of Iron,	300 grains
Inspissated Juice of Conium,	150 minims
Sugar,	1 oz. av.
Oil of Cinnamon,	6 minims
Oil of Gaultheria,	6 minims
Tincture of Tolu,	3 fl. oz.
Madeira Wine,	4 fl. oz.
Water,	4 fl. oz.

Mix together, and allow to stand for a week, when it will be ready for use.

Mixture of Iron and Conium

(Tully's)

Iron Subcarbonate,	600 grains
Extract of Conium,	300 grains
Sugar,	8 oz. troy
Oil of Cassia,	18 minims
Oil of Gaultheria,	20 minims
Compound Tincture of Cinnamon,	2 fl. oz.
Tincture of Tolu,	4 fl. dr.
Water, sufficient,	
To make	16 fl. oz.

Mix thoroughly.

Mixture, Magnesia

(Dr. Isaac Remington's)

Magnesia (Husband's),	90 grains
Blue Mass,	30 grains
Aromatic Spirit of Ammonia,	2 fl. dr.
Sugar,	60 grains
Peppermint Water,	2 fl. oz.
Lime Water,	3 fl. oz.

Mix. A tablespoonful every two hours.

Mistura Pini Sylvestris

(Dr. Piffard's)

Tar,	100 grains
Oil of Lavender,	100 grains
Oil of Scotch Fir (*Pinus sylvestris*),	300 grains

Mix and filter.

Mixture of Potassium Citrate

Mistura Potassii Citratis. Neutral Mixture. U. S. 1880

Fresh Lemon Juice, strained, 100 parts, or	4 fl. oz.
Potassium Bicarbonate, about 10 parts, or a sufficient quantity,	170 grains

Add the potassium bicarbonate gradually to the lemon juice until it is neutralized.

This preparation should be freshly made when wanted for use.

Mixture, Salicylic

(Thiersch's)

Salicylic Acid,	80 grains
Syrup of Orange Peel,	2 fl. oz.
Alcohol,	3 fl. oz.
Water, sufficient,	
To make	10 fl. oz.

Mix. Dose, a teaspoonful.

Mixture, Spleen

(Gadberry's)

Potassium Nitrate,	300 grains
Quinine Sulphate,	65 grains
Iron Sulphate,	65 grains
Nitric Acid,	65 minims
Water,	16 fl. oz.

Mix. Dose, a tablespoonful three times a day.

Mixture, Startin's

Ferrous Sulphate,	60 grains
Magnesium Sulphate,	1 oz. troy
Tincture of Gentian,	1 fl. oz.
Diluted Sulphuric Acid,	4 fl. oz.
Water,	3 fl. oz.

A teaspoonful to be taken after eating.

Mixture, Stronger Laxative

(Bossu's)

Resin of Scammony,	
Resin of Jalap, of each,	½ grain
Sugar,	15 grains
Croton Oil,	2 minims
Mucilage,	30 minims
Orange Flower Water,	90 minims
Compound Syrup of Senna,	1 fl. oz.
Peppermint Water,	3 fl. oz.

Dose, a tablespoonful.

Mixture of Thymol

(L. Lewin)

Thymol,	1½ grains
Orange Flower Water,	1½ fl. oz.
Distilled Water,	3½ fl. oz.

Mix. Dose, a tablespoonful several times a day.

Mixture, Tolu Cough

Syrup of Squill,	4 fl. dr.
Tincture of Tolu,	1 fl. dr.
Syrup,	3 fl. oz.

Mix. Dose, a teaspoonful.

Mixture, Townsend's

(New York Hospital)

Red Mercuric Iodide,	1 grain
Potassium Iodide,	300 grains
Syrup of Orange Peel,	2 fl. oz.
Compound Tincture of Cardamom,	2 fl. dr.
Water, sufficient,	
To make	4 fl. oz.

Mix. Dose, 1 to 4 teaspoonfuls.

Mouth Wash

(Dakin)

Chlorazene,	7½ grains
Menthol,	1 grain
Glycerin,	120 grains
Cinnamon Water,	2 fl. oz.
Spirit of Methyl Salicylate,	15 minims
Distilled Water, a sufficient quantity,	
To make	8 fl. oz.

Mucilage of Cydonium

MUCILAGO CYDONII. U. S. 1880

Cydonium, 2 parts, or	36 grains
Distilled Water, 100 parts, or	4 fl. oz.

Macerate the cydonium for half an hour, in a covered vessel, with the distilled water, frequently agitating. Then strain the liquid through muslin, without pressure. This preparation should be freshly made, when required for use.

Number One

(Thomsonian name)

Lobelia inflata.

Number Five

RESTORATIVE CORDIAL

(Thomsonian name)

White Aspen,	
Black Aspen,	
Poplar Bark, of each,	8 oz. av.
Bayberry Root Bark,	16 oz. av.

Boil a few minutes in 2 gallons of water, strain, add 7 pounds of sugar, skim, and then add 3 quarts of brandy.

Oil of Bitter Almond, Iodized

Iodine,	20 grains
Oil of Bitter Almond,	1 fl. dr.

Mix, and shake occasionally for two months.

Oil, British

Petroleum (Barbados),	1 fl. oz.
Petroleum (American),	1 fl. oz.
Oil of Turpentine,	2 fl. oz.
Oil of Linseed,	24 fl. oz.
Oil of Amber,	8 fl. oz.
Oil of Juniper,	2 fl. dr.

Mix them well together.

Oil, Gray

Mercury,	300 grains
Mercurial Ointment,	15 grains
Sterile White Petrolatum,	146 grains
Sterile Liquid Petrolatum,	308½ grains

Triturate the mercury, mercurial ointment, and 2.5 Gm. of white petrolatum, in a sterile mortar, until the mercury is extinguished, then add the other ingredients.

NOTE.—This preparation should be kept at a uniform temperature and must not be warmed before injecting it, as this tends to break up the fine state of subdivision of the mercury and forms larger globules, which are objectionable.

Oil, Haarlem

Sulphurated Oil,	12 fl. oz.
Petroleum (Barbados),	4 fl. oz.
Oil of Amber (crude),	6 fl. oz.
Oil of Turpentine,	32 fl. oz.
Linseed Oil,	16 fl. oz.

Mix. The sulphurated oil is made by boiling 1 part of sulphur with 8 parts of olive oil until they are united.

Ointment, Antimonial

UNGUENTUM ANTIMONII. U. S. 1870

Antimony and Potassium Tartrate,	100 grains
Lard,	400 grains

Rub the antimony and potassium tartrate with the lard, gradually added, until they are thoroughly mixed.

Ointment, Bismuth Oxide

(McCall Anderson)

Bismuth Oxide,	50 grains
Oleic Acid,	1 fl. oz.
White Wax,	150 grains
Vaseline,	1 oz. troy
Oil of Rose,	1 minim

Mix.

Ointment of Cantharides

UNGUENTUM CANTHARIDIS. U. S. 1870

Cantharides,	
Yellow Wax, of each,	1 oz. av.
Olive Oil,	6 fl. oz.

Infuse the cantharides in the oil in a covered vessel for twelve hours; then place the vessel in boiling water for fifteen minutes, strain through muslin with strong pressure, add the product to the wax, previously melted, and stir constantly while the mixture cools.

Ointment, Chalk

Prepared Chalk,	120 grains
Olive Oil,	90 minims
Lard,	270 grains

Mix.

Ointment of Copper Citrate

(Hoffman)

Copper Citrate,	123 grains
Glycerite Boroglycerin,	2 oz. av. 360 grains
Wool Fat,	31 grains
White Petrolatum,	154 grains

Heat the glycerite to 125° C. (257° F.), and slowly add the copper citrate and continue the heat until it is all dissolved. Remove the heat, and when cooled to 75° C. (167° F.) add the wool fat and petrolatum, and stir constantly until cooled to 50° C. (122° F.), and transfer to air-tight containers (collapsible tubes).

Ointment of Creosote

UNGUENTUM CREASOTI. U. S. 1870

Creosote,	1 fl. dr.
Lard,	2 oz. troy

Mix thoroughly.

Ointment of Croton Oil

Croton Oil,	30 minims
Lard,	1 oz. troy

Mix gradually.

Ointment, Elemi

Elemi (Resin),	60 grains
Cerate,	1 oz. troy
Rosin Cerate,	120 grains
Balsam of Peru,	120 minims

Fuse together, and mix thoroughly.

Ointment of Gallic Acid

Unguentum Acidi Gallici. U. S. 1880

Gallic Acid, 10 parts, or	48 grains
Benzoinated Lard, 90 parts, or	1 oz. av.
To make 100 parts, or about	1 oz. av.

Rub the gallic acid with the benzoinated lard, gradually added, until they are thoroughly mixed, avoiding the use of an iron spatula.

Ointment, Garlic

Fresh Garlic,	6 bulbs
Lard,	2 oz. troy

Digest at a moderate heat for an hour, and strain.

Ointment, Glycerin

Spermaceti,	240 grains
White Wax,	60 grains
Glycerin,	1 fl. oz.
Expressed Oil of Almond,	3 fl. oz.

Melt the wax and spermaceti with the oil at a moderate heat; put these in a Wedgewood mortar, add the glycerin, and triturate until cold.

Ointment, Iodized

Oleic Acid,	120 grains
Hydrous Wool Fat,	120 grains
Iodine, 5 per cent.	

Powder the iodine in a mortar, mix with the hydrous wool fat, and add the oleic acid.

Ointment of Sulphur Iodide

Unguentum Sulphuris Iodidi. U. S. 1870

Suphur Iodide,	30 grains
Prepared Lard,	1 oz. troy

Triturate the sulphur iodide in a porcelain mortar, and gradually add the lard, rubbing them together until the ointment is perfectly smooth and free from grittiness.

Ointment, Iodine, Compound

Unguentum Iodinii Compositum. U. S. 1870

Iodine,	15 grains
Potassium Iodide,	30 grains
Water,	30 minims
Lard,	1 oz. troy

Dissolve the iodine and potassium iodide in the water, then incorporate the solution with the lard.

Ointment, Iodoform, Compound

(Dr. J. William White's)

Iodoform,	60 grains
Oil of Anise,	20 minims
Oil of Rose,	5 minims
Oil of Ylang-Ylang,	5 minims
Ointment of Rose Water,	1 oz. troy

Mix.

Ointment, Iodoform, Compound

(New York Hospital)

Iodoform,	
Tannic Acid, of each,	60 grains
Vaseline,	1 oz. troy

Mix.

Ointment, Judkin's

Lead Acetate,	360 grains
Lead Oxide (Red),	1 oz. troy
Sodium Borate,	60 grains
Oil of Turpentine,	15 minims
Olive Oil,	2 fl. dr.
Linseed Oil,	4 fl. oz.

Boil the first two oils together for four hours, remove from the fire, add, with stirring, the lead oxide, sodium borate, and lead acetate; when nearly cool, add the turpentine.

Ointment of Mercury, Compound

Mercurial Ointment,	120 grains
Ointment of Belladonna,	120 grains
Iodine Ointment,	120 grains

Mix.

Ointment, Mezereum

Unguentum Mezerei. U. S. 1880

Fluidextract of Mezereum, 25 parts, or	2 fl. dr.
Lard, 80 parts, or	360 grains
Yellow Wax, 12 parts, or	54 grains
To make about	1 oz. av.

Melt together the lard and wax with a moderate heat, add the fluidextract, and stir the mixture constantly until the alcohol has evaporated; then continue to stir until cool.

Ointment, Naphthol

(Hardy's)

Naphthol,	120 grains
Vaseline,	2½ oz. troy

Dissolve the naphthol in half its weight of ether; mix this solution with a portion of the vaseline, and heat to about 40° C. (104° F.) until the ether is completely evaporated; then add the remainder of the vaseline, and triturate thoroughly; finally, preserve the ointment in a well-covered vessel.

Ointment, Pile

Morphine Acetate,	5 grains
Tannic Acid,	30 grains
Solution of Lead Subacetate,	1 fl. dr.
Ointment,	420 grains

Incorporate the solution with the ointment, then add the other ingredients.

Ointment of Red Mercuric Iodide

Unguentum Hydrargyri Iodidi Rubri.
U. S. 1870

Red Mercuric Iodide in fine powder,	16 grains
Simple Ointment,	1 oz. av.

Mix thoroughly.

Ointment, Scarlet Red

I

(J. K. Thum)

Scarlet Red, Medicinal, Biebrich,	123 grains
Castor Oil,	154 grains
Petrolatum, a sufficient quantity,	
To make	3 oz. av. 231 grains

II

Scarlet Red, Medicinal, Biebrich,	62 grains
Olive Oil,	185 grains
Lanolin,	1 oz. av. 25½ grains
Petrolatum, a sufficient quantity,	
To make	3 oz. av. 231 grains

Ointment, Scott's

Strong Mercurial Ointment,	1 oz. troy
Soap Cerate,	1 oz. troy
Powdered Camphor,	60 grains

Mix.

Ointment, Tobacco

Tobacco, in fine powder,	120 grains
Lard,	4 oz. troy
Water, sufficient.	

Percolate the tobacco with water until 2 fl. oz. have been obtained, evaporate to an extract, and mix with the lard.

Ointment, Tetter

(Dr. S. G. Morton)

Alum,	120 grains
Lead Carbonate,	120 grains
Calomel,	120 grains
Oil of Turpentine,	2 fl. dr.
Ointment,	1½ oz. troy

Triturate the powders together till they are impalpable and thoroughly mixed; then incorporate them with the oil and ointment.

Paper, Cantharides

Charta Cantharidis. U. S. 1880

White Wax, 8 parts, or	4 oz. av.
Spermaceti, 3 parts, or	1½ oz. av.
Olive Oil, 4 parts, or	2 fl. oz.
Canada Turpentine, 1 part, or	½ oz. av.
Cantharides, in No. 40 powder, 1 part, or	½ oz. av.
Water, 10 parts, or	5 fl. oz.

Mix all the substances in a tinned vessel, and boil gently for two hours, constantly stirring. Strain through a woolen strainer without expressing, and, by means of a water bath, keep the mixture in a liquid state in a shallow, flat-bottomed vessel with an extended surface. Coat strips of sized paper with the melted plaster, on one side only, by passing them successively over the surface of the liquid; when dry, cut the strips into rectangular pieces.

Paraffin Dressing for Burns

Resorcinol,	1 part
Oil Eucalyptus,	2 parts
Olive Oil,	5 parts
Paraffin,	67 parts
Petrolatum,	25 parts

See *A. Ph. A.*, Feb., 1917, p. 136.
See *J. A. M. A.*, Feb., 1917, p. 373.
See *J. A. M. A.*, April, 1917, p. 1037.

Note.—The resorcinol in some cases has produced poisonous effects, especially when large areas were covered with the dressing. In such cases it is well to replace the resorcinol with some other suitable antiseptic or omit it entirely.

Paste, Bismuth

(Beck's)

Bismuth Subnitrate,	1 oz. av. 25 grains
White Wax,	77 grains
Paraffin,	77 grains
Yellow Petrolatum,	2 oz. av. 51 grains

Melt the paraffin, wax, and petrolatum, add the bismuth subnitrate, sterilize the mixture by heating it on a sand bath at 140° C. (284° F.) for thirty minutes, and dispense it in a sterile, collapsible tube.

Paste, Canquoin's

Fused Zinc Chloride,	300 grains
Wheat Flour,	420 grains
Alcohol,	1 fl. dr.

Rub the zinc chloride to a fine powder, and make a paste with the alcohol; then add the wheat flour, using strong pressure with the pestle. When the paste is homogeneous, spread with a roller into sheets about one-eighth of an inch thick, and, after a few hours' exposure, preserve in well-corked bottles.

Paste, Hand

I

Ivory Soap,	2½ ℔
Powdered Pumice,	1 ℔
Hot Water, a sufficient quantity,	
To make	8 ℔

II

(W. R. White)

Powdered Pumice,	4½ ℔
Green Soap,	1¼ ℔
Potassium Carbonate,	280 grains
Glycerin,	2 fl. oz.
Water,	26 fl. oz.

Dissolve the soap and potassium carbonate in the water by the aid of heat, add the glycerin, and rub this solution up well in a mortar with the pumice stone until it is of paste-like consistence.

III

Powdered Castile Soap,	7 oz. av.
Borax,	2 oz. av.
Powdered Pumice,	1 oz. av.
China Clay, light,	10 oz. av.

Mix.

Paste, Zinc Chloride

(Latour's)

Zinc Chloride,	300 grains
Zinc Nitrate,	600 grains
Water,	1 fl. oz.

Dissolve with the aid of heat, and when cool add to each ounce 300 grains of wheat flour. Make a paste, and then roll into sheets one-eighth of an inch thick. Preserve in well-stoppered bottles.

Paste, Coster's

Iodine, Pigment,	120 grains
Oil of Cade,	1 oz. troy

Mix. For an embrocation. This preparation should not be used until it has stood four weeks. The iodine pigment is made by dissolving 60 grains of iodine in 1 fl. oz. of alcohol, and allowing the solution to stand in a glass bottle for several months before use.

Paste, Iodoform

Iodoform,	60 grains
Mucilage of Acacia,	10 minims
Glycerin,	10 minims
Oil of Peppermint,	1 minim

Mix.

Pencils, Croton Oil

(Limousin's)

Croton Oil,	2 fl. dr.
White Wax,	60 grains
Oil of Theobroma,	60 grains

Melt the wax and oil of theobroma together, by means of a water bath, in a flask, adding the croton oil, and keep the flask corked until the mixture begins to congeal; then pour into suitable cylindrical moulds, one-fourth to one-third of an inch in diameter. The pencils are covered with tin foil and kept in closed vessels.

Pencils, Iodoform

Iodoform,	
Oil of Theobroma, of each,	31 grains

Triturate together, and roll the mass into 5 pencils, one-twelfth of an inch thick, then dust with lycopodium.

Pencils of Copper Sulphate, Cauterizing

Copper Sulphate,	240 grains
Sodium Borate,	60 grains

Triturate together in a warm mortar; the mass becomes soft from the liberation of water of crystallization, and it may be readily rolled into sticks. If it becomes too dry, a little water may be added.

Pills of Lead Acetate

(University College, London)

Lead Acetate,	12 grains
Morphine Hydrochloride,	6 grains
Extract of Hyoscyamus,	48 grains

Make a mass, and divide into 24 pills.

Pills of Aloin and Podophyllin

Aloin,	24 grains
Podophyllin,	12 grains
Oleoresin of Ginger,	4 minims

Triturate the solid ingredients into a uniform powder, add the oleoresin, make a mass, and divide into 24 pills. Dose, one to three pills.

Pills, Anderson's Scots

Aloes,	1 oz. troy
Soap,	80 grains
Colocynth,	20 grains
Gamboge,	20 grains
Oil of Anise,	10 minims

Reduce the aloes, colocynth, and gamboge to a very fine powder; then beat them and soap with water into a mass of a proper consistence to divide into pills each containing 3 grains.

Pills, Anti-Gout

(Corlieu's)

Sodium Silicate,	20 grains
Extract of Colchicum,	12 grains
Extract of Aconite,	25 grains
Sodium Benzoate,	40 grains
Powdered Soap,	40 grains

Mix, and make into 100 pills.

Pills, Aperient

(Dr. Mitchell's)

Powdered Aloes,	24 grains
Powdered Rhubarb,	48 grains
Mild Mercurous Chloride,	4 grains
Antimony and Potassium Tartrate,	2 grains

Make into a mass and divide into 24 pills.

Pills, Boisragon

(Dr. Hewson's formula)

Mild Mercurous Chloride,	12 grains
Powdered Scammony,	12 grains
Compound Extract of Colocynth,	40 grains
Oil of Caraway,	4 minims
Aloes,	8 grains

Mix, and make into 14 pills.

Pills of Chinoidine

Chinoidine,	60 grains
Diluted Sulphuric Acid, sufficient.	

Soften the chinoidine with the acid, in a mortar, and divide into 20 pills.

Pills, Cobb's

Extract of Hyoscyamus,	30 grains
Extract of Conium,	30 grains
Extract of Colocynth,	40 grains
Extract of Nux Vomica,	4 grains

Mix, and divide into 30 pills.

Pills of Copaiba, Compound

Copaiba,	30 grains
Powdered Cubeb,	50 grains
Wax,	15 grains

Melt the wax by a gentle heat, then add the copaiba, and immediately afterwards sift in the cubeb, stirring thoroughly; while it is yet warm, roll out into 25 pills.

Pills of Croton Oil

Croton Oil,	6 minims
Crumbs of Bread,	24 grains

Make into 24 pills.

Pills, Cutter's

(For habitual costiveness)

Powdered Ipecac,	10 grains
Mild Mercurous Chloride,	3 grains
Extract of Taraxacum,	40 grains

Make into a mass and divide into 30 pills. Dose, 1 three times a day.

Pills, Diarrhœa

(Prof. William Thompson's)

Lead Acetate,	16 grains
Powdered Camphor,	12 grains
Powdered Opium,	3 grains
Bismuth Subcarbonate,	12 grains
Extract of Gentian, sufficient.	

Mix, and make into 12 pills.

Pills, Dinner

(Fothergill's)

Powdered Ipecac,	20 grains
Strychnine,	1 grain
Oil of Black Pepper,	40 minims
Pill of Aloes and Myrrh,	50 grains

Mix, and make into 20 pills.

Pills, Gout

(Becquerel's)

Quinine Sulphate,	60 grains
Extract of Digitalis,	7½ grains
Powdered Colchicum Seed,	20 grains

Make into a mass and divide into 25 pills. Dose, one to three pills each day for several days.

Pills, Gout

(Lartigue's)

Compound Extract of Colocynth,	96 grains
Acetic Extract of Colchicum,	10 grains
Extract of Digitalis,	5 grains

Make into a mass and divide into 24 pills. Take two for a dose.

Pills, Emmenagogue

(Dr. Otto's)

Dried Iron Sulphate,	48 grains
Powdered Aloes,	12 grains
Turpentine,	32 grains
Oil of Turpentine,	10 minims

Make a mass, and divide into 30 pills. Dose, two, three times a day.

Pills of Galbanum, Compound

PILULÆ GALBANI COMPOSITÆ. U. S. 1880

Galbanum,	150 grains
Myrrh,	150 grains
Asafetida,	50 grains
Syrup, a sufficient quantity,	
To make	100 pills

Pills, Grissolle's

Alcoholic Extract of Nux Vomica,	4 grains
Iron Phosphate,	46 grains
Extract of Quassia,	31 grains
Extract of Gentian, sufficient.	

Mix, and make into 25 pills. One pill three times a day, in conjunction with cold hip baths, and abstention from drink during the evening. Used for incontinence of urine.

Pills, Hooper's

Powdered Ginger,	60 grains
Powdered Canella,	60 grains
Extract of Black Hellebore,	120 grains
Myrrh,	120 grains
Soap,	120 grains
Dried Iron Sulphate,	130 grains
Aloes,	1 oz. troy

Beat them well together into a mass with syrup or water, and divide into pills each containing 2½ grains.

Pills of Mercurous Iodide, Compound

Yellow Mercurous Iodide,	10 grains
Guaiac Resin,	40 grains
Extract of Gentian,	30 grains

Triturate the Guaiac Resin into a mass with a little alcohol; then incorporate with it the extract and mercurous iodide, and divide into 20 pills.

Pills, Iron

Reduced Iron,	100 grains
Manna,	30 grains
Glucose, sufficient.	

Make a mass, and divide into 50 pills.

Pills of Iron, Compound

Pilulæ Ferri Compositæ. U. S. 1880

Myrrh, in fine powder,	150 grains
Sodium Carbonate,	75 grains
Ferrous Sulphate,	75 grains
Syrup, a sufficient quantity,	
To make	100 pills

Pills of Iron, Compound

(Thomson's)

Iron Subcarbonate,	60 grains
Extract of Conium,	60 grains

Mix, and divide into 24 pills.

Pills, Knight's

Powdered Aloes,	54 grains
Powdered Scammony,	27 grains
Powdered Gamboge,	9 grains

Mix, and make into 20 pills.

Pills, Liver

(Dr. Chapman)

Powdered Rhubarb,	60 grains
Powdered Ipecac,	10 grains
Oil of Caraway,	10 minims
Powdered Acacia, sufficient.	

Mix, and make into 20 pills.

Pills, Marshall's

Compound Extract of Colocynth,	
Mass of Mercury,	
Powdered Aloes,	
Powdered Soap,	
Powdered Rhubarb, of each,	60 grains

Make into 60 pills.

Pills, Neuralgia

(Prof. Gross's)

Quinine Sulphate,	60 grains
Morphine Sulphate,	1½ grains
Strychnine,	1 grain
Arsenic Trioxide,	1½ grains
Extract of Aconite,	15 grains

Mix, and make into 30 pills.

Pills of Nickel Bromide

(Dr. Da Costa's)

Nickel Bromide,	60 grains
Powdered Althæa,	6 grains
Extract of Gentian,	6 grains
Alcohol, sufficient.	

Mix, and make into 12 pills.

Pills No. 3 (Anti-Canker)

(Thomsonian name)

Capsicum,	1 oz. av.
Extract of Bayberry,	1 oz. av.

Make into pills.

Pills, Rheumatic

(Dr. Isaac Remington's)

Acetic Extract of Colchicum,	
Compound Extract of Colocynth,	
Extract of Rhubarb, of each,	60 grains
Veratrine,	5 grains
Oil of Anise,	10 drops

Make into 40 pills. Take one or two at bedtime.

Pills, Sedative

(Gunther's)

Powdered Asafetida,	57 grains
Extract of Valerian,	57 grains
Extract of Belladonna,	3 grains
Zinc Oxide,	1 grain
Castor,	2 grains

Mix, and make into 24 pills. Dose, one to two pills twice daily in chorea.

Pills of Silver Nitrate

I

Silver Nitrate,	20 grains
Powdered French Chalk,	80 grains
Petrolatum, q. s.	

Make a mass, and divide into 40 pills.

II

Silver Nitrate,	6 grains
Kaolin,	12 grains
Hardened Petrolatum,	6 grains
Rosin Cerate,	2 grains

Mix and make into 12 pills.

Pill of Soap, Compound

Pilula Saponis Composita. U. S. 1870

Opium, in fine powder,	60 grains
Soap, in fine powder,	240 grains

Beat them together with water so as to form a pilular mass.

Pills of Squill, Compound

Pilulæ Scillæ Compositæ. U. S. 1870

Squill, in fine powder,	12 grains
Ginger, in fine powder,	
Ammoniac, in fine powder, of each,	24 grains
Soap, in fine powder,	36 grains
Syrup, a sufficient quantity.	

Mix the powders, then beat them with syrup so as to form a pilular mass. To be divided into 24 pills.

Pills, Tonic

(Aitken's)

	Each pill contains
Reduced Iron,	⅔ grain
Quinine Sulphate,	1 grain
Strychnine, alkaloid,	$^1/_{50}$ grain
Arsenic Trioxide,	$^1/_{50}$ grain

(See Pilulæ Ferri, Quininæ, Strychninæ et Arseni Fortiores, N. F.)

Pills, Tonic Laxative

(Dr. C. H. Thomas)

Powdered Aloes,	24 grains
Dried Ferrous Sulphate,	24 grains
Alcoholic Extract of Hyoscyamus,	6 grains
Extract of Nux Vomica,	6 grains
Oleoresin of Capsicum,	4 grains

Make into a mass, and divide into 24 pills.

Plaster, Ammoniac

EMPLASTRUM AMMONIACI. U. S. 1880

Ammoniac, 100 parts, or	5 oz. av.
Diluted Acetic Acid, 140 parts, or	½ pint

Digest the ammoniac in the diluted acetic acid, in a suitable vessel, avoiding contact with metals, until it is entirely emulsionized; then strain, and evaporate the strained liquid, by means of a water bath, stirring constantly, until a small portion, taken from the vessel, hardens on cooling.

Plaster, Antimonial

EMPLASTRUM ANTIMONII. U. S. 1870

Antimony and Potassium Tartrate, in fine powder,	1 oz. troy
Burgundy Pitch,	4 oz. troy

Melt the pitch by means of a water bath and strain; then add the powder, and stir them well together until the mixture thickens on cooling.

Plaster, Asafetida

EMPLASTRUM ASAFŒTIDÆ. U. S. 1880

Asafetida, 35 parts, or	13 oz. av.
Lead Plaster, 35 parts, or	13 oz. av.
Galbanum, 15 parts, or	5½ oz. av.
Yellow Wax, 15 parts, or	5½ oz. av.
Alcohol, 120 parts, or	3 pints

Digest the asafetida and galbanum with the alcohol on a water bath, separate the liquid portion, while hot, from the coarser impurities by straining, and evaporate it to the consistence of honey; then add the lead plaster and the wax, previously melted together, stir the mixture well, and evaporate to the proper consistence.

Plaster, Breast

(Dewees's)

Ammoniac Plaster,	120 grains
Lead Plaster,	1½ oz. troy
Logan's Plaster,	360 grains
Spermaceti,	60 grains
Camphor,	60 grains

Melt the plaster, then add the spermaceti and camphor, and remove from the fire.

Plaster, Canada Pitch

HEMLOCK PITCH PLASTER. EMPLASTRUM PICIS CANADENSIS. U. S. 1880

Canada Pitch, 90 parts, or	9 oz. av.
Yellow Wax, 10 parts, or	1 oz. av.
To make 100 parts, or	10 oz. av.

Melt them together, strain the mixture, and stir constantly until it thickens on cooling.

Plaster, Galbanum

EMPLASTRUM GALBANI. U. S. 1880

Galbanum, 16 parts, or	8 oz. av.
Turpentine, 2 parts, or	1 oz. av.
Burgundy Pitch, 6 parts, or	3 oz. av.
Lead Plaster, 76 parts, or	38 oz. av.
To make 100 parts, or	50 oz. av.

To the galbanum and turpentine, previously melted together and strained, add, first, the Burgundy pitch, then the lead plaster, melted over a gentle fire, and mix the whole thoroughly.

Plaster, Logan's

Lead Oxide,	2 oz. av.
Lead Carbonate,	2 oz. av.
Soap,	1½ oz. av.
Fresh Butter,	240 grains
Olive Oil,	5 fl. oz.
Powdered Mastic,	20 grains

Mix the soap, oil, and butter together, then add the lead oxide, and boil it gently over a slow fire for an hour and a half, or until it has a pale brown color, stirring constantly; the heat may then be increased, and the boiling continued, till a portion of the melted plaster, being dropped on a smooth board, is found not to adhere; then remove it from the fire, and add the mastic.

Plaster, Mercurial

(De Vigo's)

Lead Plaster,	2000 grains
Yellow Wax,	100 grains
Resin,	100 grains
Powdered Olibanum,	30 grains
Ammoniac,	30 grains
Powdered Bdellium,	30 grains
Powdered Myrrh,	30 grains
Powdered Saffron,	20 grains
Mercury,	600 grains
Turpentine,	100 grains
Storax,	300 grains
Oil of Lavender,	10 grains

Mix.

Potion of Todd

(Dorvault's)

Brandy,	6 fl. dr.
Distilled Water,	9 fl. dr.
Syrup,	4 fl. dr.
Tincture of Canella,	1 fl. dr.

Mix.

Poultice, Charcoal

(Thomsonian name)

Charcoal,	1 oz. troy
Ginger,	
Bayberry, of each,	240 grains
Elm,	1 oz. troy
Hot Water, sufficient.	

Mix.

Powders, Antispasmodic

(Dr. Otto's)

Ground Black Mustard,	240 grains
Powdered Salvia,	240 grains
Powdered Ginger,	240 grains

Mix. Dose, in epilepsy, three teaspoonfuls for three mornings in succession; discontinue three mornings, and then give as before. To be mixed in water or molasses.

Powder of Camphor, Compound

(Gallop's Powder)

Camphor,	
Powdered Acacia,	
Sugar, of each,	1 oz.

Mix.

Powders, Chalk

Prepared Chalk,	180 grains
Acacia,	60 grains
Sugar,	60 grains
Cinnamon (powdered),	15 grains

Mix, and divide into 12 powders

Powder, Cough

(Thomsonian name)

Lobelia,	
Glycyrrhiza,	
Skunk Cabbage,	
Sugar, of each,	1 oz. troy

Mix.

Powder, Curry

Coriander,	5 ℔
Turmeric,	1½ ℔
Fenugreek,	12 oz.
Black Pepper,	8 oz.
Cumin,	8 oz.
Mustard,	8 oz.
Dill,	4 oz.
Pimento,	4 oz.
African Ginger,	4 oz.
Table Salt,	1½ oz.
Capsicum,	1¼ oz.

Grind the ingredients together to a fine powder.

Powders, Diarrhœa

Powdered Alum,	240 grains
Powdered Kino,	60 grains
Powdered Opium,	3 grains

Mix and divide into 12 powders. For use in obstinate cases. Dose, 1 every two or three hours.

Powder, Digestive, Compound

(N. F. III)

Saccharated Pepsin,	225 grains
Pancreatin,	225 grains
Diastase,	15 grains
Lactic Acid,	15 minims
Hydrochloric Acid,	30 minims
Sugar of Milk,	960 grains

Add the acids gradually to the sugar of milk and triturate until thoroughly mixed. Add the pepsin, pancreatin and diastase, then incorporate by trituration. Finally rub through a hair sieve and preserve in bottles.

Powder, Dover's Camphorated

(Dr. Eli Ives's)

Potassium Bitartrate,	1 oz. troy
Powdered Camphor,	120 grains
Powdered Ipecac,	60 grains
Powdered Opium,	60 grains

Mix, and pass through a fine sieve.

Powder, Laxative

(Jeannel's)

Potassium and Sodium Tartrate,	600 grains
Sodium Bicarbonate,	240 grains
Tartaric Acid,	240 grains
Oil of Lemon, sufficient	
Sugar,	2½ oz. troy

Dose, a teaspoonful in sweetened water.

Powder, Nerve

(Thomsonian name)

Powdered Cypripedium.

Powder, Neutralizing

Sodium Bicarbonate,	120 grains
Powdered Rhubarb,	120 grains
Oil of Peppermint,	2 minims

Dose, a teaspoonful, as an antacid in diarrhœa and dyspepsia.

Powder, Pectoral

(Wedel's)

Benzoic Acid,	8 grains
Washed Sulphur,	75 grains
Glycyrrhiza,	250 grains
Iris,	30 grains
Sugar,	300 grains
Oil of Anise,	4 minims
Oil of Fennel,	4 minims

Mix. A tablespoonful three or four times a day in bronchitis, severe cough, or croup.

Powder, Potter's

Prepared Chalk,	3 oz. troy
Powdered Camphor,	240 grains
Ammonium Carbonate,	1 oz. troy

Mix.

Powder, Schuyler's

Morphine Sulphate,	15 grains
Camphor,	90 grains
Powdered Ipecac,	90 grains
Powdered Glycyrrhiza,	1½ oz. troy
Sugar,	1½ oz. troy

Mix.

Powder of Senna, Compound

Powdered Senna,	2 oz. troy
Potassium Bitartrate,	2 oz. troy
Powdered Scammony,	240 grains
Powdered Ginger,	120 grains

Mix. Dose, twenty to thirty grains.

Remedy, Cholera

(Dr. Dwight's)

Tincture of Camphor,	1 fl. oz.
Tincture of Opium,	1 fl. oz.
Compound Tincture of Rhubarb,	1 fl. oz.

Mix. Dose, half a teaspoonful.

Remedy for Tape-Worm

(Schafhirt's)

Pomegranate,	240 grains
Pumpkin Seed,	1 oz. troy
Ethereal Extract of Aspidium,	60 grains
Powdered Ergot,	30 grains
Powdered Acacia,	120 grains
Croton Oil,	2 minims

Mix.

Remedy, Whooping Cough

(Dr. J. J. Caldwell's)

Ammonium Bromide,	20 grains
Potassium Bromide,	40 grains
Fluidextract of Belladonna,	6 minims
Distilled Water,	2 fl. oz.

Used with steam atomizer for ten or fifteen minutes morning, noon, and bedtime.

Salve, Mother's

EMPLASTRUM FUSCUM ONGUENT DE LA MÈRE

Lead Oxide,	60 grains
Burgundy Pitch,	12 grains
Yellow Wax,	60 grains
Mutton Tallow,	60 grains
Lard,	60 grains
Olive Oil,	120 grains
Butter,	60 grains

Place the fatty substances in a suitable vessel, and heat them until they begin to smoke; then add the lead oxide in small portions, constantly stirring the mass with a wooden spatula. Keep the mixture over the fire, constantly agitating, until it acquires a brown color, then mix in the pitch and pour into moulds.

Salve, Naphthol

(Kaposi's)

Naphthol,	180 grains
Green Soap,	600 grains
Prepared Chalk,	120 grains
Lard,	2½ oz. av.

Mix. Used in itch. The affected part to be rubbed twice a day.

Salve, Thomson's

(Thomsonian name)

Yellow Wax,	2 oz. troy
Fresh Butter,	2 oz. troy
Turpentine,	4 oz. troy
Balsam of Fir,	2 oz. troy

Mix.

Sedative, Battley's

Extract of Opium,	360 grains
Boiling Water,	7 fl. oz.
Alcohol,	1½ fl. oz.
Cold Water, sufficient,	
To make	10 fl. oz.

Dissolve the extract in boiling water; when cold, add to the solution the alcohol and enough water to make 10 fl. oz., and, lastly, filter through paper. Dose, 5 minims.

Sick Room Deodorizer

Coumarin,	31 grains
Oil of Lavender,	32 minims
Oil of Bitter Almond,	65 minims
Oil of Clove,	195 minims
Oil of Eucalyptus,	260 minims
Oil of Patchouli,	10 drops

Mix and use as a spray.

Smelling Salts, Dry

For small vinaigrette or containers for smelling salts, to be carried in ladies' traveling or hand bags, a satisfactory filler may be prepared by thoroughly mixing equal parts of dry potassium carbonate and ammonium chloride, with active trituration, and adding a drop or more of oil of lavender flowers or other suitable perfume.

Snuff, Bismuth Catarrh

Bismuth Subnitrate,	360 grains
Morphine Hydrochloride,	2 grains
Acacia,	120 grains

Mix.

Snuff, Hay-Fever

(Dr. Mortimer Granville's)

Sodium Borate,	20 grains
Capsicum,	15 grains
Ammonium Carbonate,	10 grains

Mix.

Solution, Adler's

Sodium Chloride,	9 grains
Sodium Bicarbonate,	5 grains
Potassium Chlorate,	3/5 grain
Calcium Chloride,	3/5 grain
Magnesium Chloride,	2/5 grain
Monobasic Sodium Phosphate,	9/50 grain
Glucose,	2 grains
Distilled Water (freshly distilled), a sufficient quantity,	
To make	33 fl. oz., 390 grains

This solution must be sterile when dispensed. It closely approximates the blood serum in its constituents, and provides a mechanism for maintaining its reaction and for neutralizing acids and alkalies.

Solution of Ammonium Arsenate

(Biette's Arsenical Solution)

Ammonium Arsenate,	2 grains
Distilled Water,	2 fl. oz.

Mix. Dose, 20 drops.

Solution of Ammonium Valerate

TASTELESS AND ODORLESS

(Rother's)

Ammonium Valerate,	119 grains
Sodium Borate (Powdered),	191 grains
Ammonia Water, sufficient	
Distilled Water, sufficient,	
To make	8 fl. oz.

Mix the ammonium valerate with 1 fl. oz. of distilled water, and add ammonia water, drop by drop, until a clear and slightly alkaline solution is produced; then add 2 fl. oz. of distilled water and the sodium borate, and when all has dissolved, add distilled water to make 8 fl. oz., and filter.

Solution, Antiseptic

(Volkman's)

Thymol,	30 grains
Alcohol,	5 fl. dr.
Glycerin,	10 fl. dr.
Water,	6 fl. oz.

Mix.

Solution of Arsenic Chlorophosphide

Arsenic Trioxide,	4 grains
Phosphorus,	8 grains
Diluted Hydrochloric Acid,	12 grains
Water, sufficient,	
To make	18 fl. oz.

Mix. Digest on a water bath for twenty-four hours, and decant the supernatant liquid.

Solution of Sodium Arsenite

(Harle's Solution)

Arsenic Trioxide,	15 grains
Sodium Carbonate (Exsiccated),	15 grains
Cinnamon Water,	1 fl. oz.
Distilled Water, sufficient,	
To make	4 fl. oz.

Boil the solids with 3 fl. oz. of distilled water until they are dissolved, make up the measure of 3 fl. oz. with distilled water, and add the cinnamon water. Dose, 4 minims.

Solution of Bromine

ANTIDOTE TO THE POISON OF THE RATTLESNAKE

(Bibron's)

Bromine,	150 grains
Potassium Iodide,	2 grains
Corrosive Mercuric Chloride,	1 grain
Diluted Alcohol,	4 fl. oz.

Dissolve. Take 10 drops in a tablespoonful of brandy, repeated as required.

Solution of Butyl-Chloral

CROTON-CHLORAL

Butyl-Chloral,	7 grains
Alcohol,	30 minims
Distilled Water,	2½ fl. oz.
Syrup of Orange,	2 fl. oz.

Mix. A tablespoonful every two hours.

Solution, Carrel-Dakin (Daufresne's Technic)

Dakin's solution is a solution of sodium hypochlorite for surgical use, the characteristics of which, established after numerous tests and a long practical experience, are as follows:

(*a*) *Complete Absence of Caustic Alkali.*—The absolute necessity for employing in the treatment of wounds a solution free from alkali hydroxide excludes the commercial Javel water, Labarraque's solution, and all the solutions prepared by any other procedure than the following:

(*b*) *Concentration.*—The concentration of sodium hypochlorite must be exactly between 0.45

and 0.50 per cent. Below 0.45 per cent. of hypochlorite the solution is not sufficiently active; above 0.50 per cent. it becomes irritating.

Chemicals Required for the Preparation.—Three chemical substances are indispensable to Dakin's solution: chlorinated lime, anhydrous sodium carbonate, and sodium bicarbonate. Among these three products the latter two are of a practically adequate constancy, but this is not the case with the first. Its content in active chlorine (decoloring chlorine) varies within wide limits, and it is absolutely indispensable to titrate it before using it.

Titration of the Chlorinated Lime.—There must be on hand for this special purpose:

A 25 mil burette graduated in 0.1 mil.
A pipette gaged for 10 mils.
Tenth-normal sodium thiosulphate V.S.

A sample of the chlorinated lime on hand is then taken up either with a special sound or in small quantities from the stock, which has been carefully mixed.

Weigh out 20 Gm. of this average sample, mix it as completely as possible with 1 liter of ordinary water, and leave it in contact for a few hours, agitating it from time to time. Filter.

Measure exactly with the pipette 10 mils of the clear fluid; add to it 20 mils of a 1 in 10 solution of potassium iodide and 2 mils of acetic or hydrochloric acid. Drop, a drop at a time, into this mixture the tenth-normal sodium thiosulphate V.S. until decoloration is complete.

The number of mils of the tenth-normal sodium thiosulphate V.S. required for complete decoloration, multiplied by 1.775, gives the weight of the active chlorine contained in 100 Gm. of the chlorinated lime.

This figure being known, it is applied to the following table, which will give the quantities of chlorinated lime, of sodium carbonate and of sodium bicarbonate which are to be employed to prepare 10 liters of Dakin's solution.

QUANTITIES OF INGREDIENTS FOR TEN LITERS OF DAKIN'S SOLUTION

Titer of Chlorinated Lime.	Chlorinated Lime, Gm.	Anhydrous Sodium Carbonate, Gm.	Sodium Bicarbonate, Gm.
20	230	115	96
21	220	110	92
22	210	105	88
23	200	100	84
24	192	96	80
25	184	92	76
26	177	89	72
27	170	85	70
28	164	82	68
29	159	80	66
30	154	77	64
31	148	74	62
32	144	72	60
33	140	70	59
34	135	68	57
35	132	66	55
36	128	64	53
37	124	62	52

Example: If it required 16.6 mils of the tenth-normal sodium thiosulphate V.S. for complete decoloration, the titer of the chlorinated lime in active chlorine is:

$$16.6 \times 1.775 = 29.7 \text{ per cent.}$$

The quantities to be employed to prepare 10 liters of the solution will be in this case:

Chlorinated lime	154 Gm.
Anhydrous sodium carbonate	77 Gm.
Sodium bicarbonate	64 Gm.

If crystalline sodium carbonate is being used, then instead of the 80 Gm. of anhydrous carbonate it must be replaced by:

Crystalline sodium carbonate .... 220 Gm.

Preparation of Dakin's Solution.—To prepare 10 liters of the solution proceed as follows:

Weigh exactly the quantities of chlorinated lime, sodium carbonate, and sodium bicarbonate which have been determined in the course of the preceding trial. Place the chlorinated lime in a 12-liter jar, add 5 liters of ordinary water, agitate vigorously for a few minutes, and allow it to stand for from six to twelve hours or over night.

At the same time dissolve the sodium carbonate and bicarbonate in five liters of cold water. Then, all at once, pour the solution of the sodium salts into the jar containing the chlorinated lime, agitate vigorously for a few moments, and allow it to stand quietly to permit the calcium carbonate to settle as it forms. At the end of half an hour, siphon the liquid, and filter it through double paper to obtain a clear product.

Protect the solution from light, as this causes rapid deterioration in solutions of hypochlorites. The best way to realize these conditions is to keep the finished fluid in large wicker-covered demijohns of black glass or glass containers which have been painted black.

Titration of Dakin's Solution.—It is a wise precaution to verify, from time to time, the titer of the solution. This may be done as already directed for determining the active chlorine in the chlorinated lime, using 10 mils of the solution, 20 mils of 1 in 10 solution of potassium iodide, and 2 mils of acetic or hydrochloric acid, and titrating with the tenth-normal sodium thiosulphate V.S. until decoloration is complete.

The number of mils of the V.S. employed multiplied by 0.03725 will give the weight of the sodium hypochlorite contained in 100 mils of the solution.

A solution is correct when, under the conditions given above, from 12 to 13 mils of tenth-normal thiosulphate V.S. are required to complete the decoloration:

$$13 \times 0.03725 = 0.485 \text{ per cent. of } NaOCl.$$

The Test for the Alkalinity of Dakin's Solution.—It is easy to differentiate the solution obtained by this procedure from the commercial hypochlorites and from Labarraque's solution:

Pour into a beaker about 20 mils of the fluid, and drop on the surface a few centigrams of phenolphthalein in powdered form. Dakin's solution, correctly prepared, gives absolutely no change in tint, while in the same conditions Javel water and Labarraque's fluid give an intense red coloration which indicates in the latter two solutions the presence of free caustic sodium.

Solution of Iron and Quinine Citrate

LIQUOR FERRI ET QUININÆ CITRATIS. U. S. 1880

Iron and Ammonium Citrate, 65 parts, or	568 grains
Quinine, dried at 100° C. (212° F.), until it ceases to lose weight, 12 parts, or	105 grains
Citric Acid, 28 parts, or	245 grains
Alcohol, 30 parts, or	6 fl. dr.
Distilled Water, a sufficient quantity,	
To make 200 parts, or	4 oz. av.

Dissolve the iron and ammonium citrate in 200 parts (or 4 fl. oz.) of distilled water, contained in a tared porcelain capsule, heat the solution to 60° C. (140° F.) on a water bath, add the citric acid, and, when it is dissolved, add the quinine, stirring the mixture until a perfect solution has been obtained. Evaporate this to 160 parts (or 3 oz. av.), allow it to cool, add the alcohol, and finally enough distilled water to make the solution weigh 200 parts (or 4 oz. av.).

Solution of Barium Chloride

Liquor Barii Chloridi. U. S. 1870

Barium Chloride,	1 oz. troy
Distilled Water,	3 fl. oz.

Dissolve the chloride in the distilled water, and filter through paper.

Solution, Crude Cresol, Compound

Rosin,	450 grains
Solution of Potassium Hydroxide, (50 per cent.)	16 minims
Crude Carbolic Acid,	2 fl. oz.
Water, a sufficient quantity,	
To make	3 fl. oz.

Melt the rosin without stirring, and add to it the warmed solution of potassium hydroxide, allow the effervescence to continue for a few minutes until all of the rosin has been saponified and immediately dissolve the rosin soap in the crude carbolic acid, using as little heat as possible. Finally add water to make 3 fl. oz.

Solution, Fisher's

Sodium Carbonate,	162 grains
Sodium Chloride,	227 grains
Distilled Water (freshly distilled), a sufficient quantity,	
To make	33 fl. oz., 390 minims

The distilled water should be redistilled in a Jena glass flask. This solution is for intravenous use and must be carefully sterilized before dispensing.

Solution, Iodine

(Magendie's)

Potassium Iodide,	240 grains
Iodine,	2 grains
Peppermint Water,	6 fl. oz.

Dissolve. Dose, a teaspoonful.

Solution, Locke's

Sodium Chloride,	146 grains
Potassium Chloride,	4 grains
Calcium Chloride,	2½ grains
Sodium Bicarbonate,	3 grains
Glucose,	15 grains
Distilled Water (freshly distilled), a sufficient quantity,	
To make	33 fl. oz., 390 minims

Sometimes ordered without glucose. It must be carefully sterilized before dispensing.

Solution of Magnesium Acetate

Liquor Magnesii Acetatis

(Neynaber's)

Calcinated Magnesia,	126 grains
Acetic Acid, sufficient to saturate,	
Syrup of Citric Acid,	2 fl. oz.
Potassium Bicarbonate	40 grains
Water,	
To make	12 fl. oz.

Made and used like solution of magnesium citrate (see page 804).

Solution of Morphine Sulphate

Liquor Morphinæ Sulphatis. U. S. 1870

Morphine Sulphate,	8 grains
Distilled Water,	8 fl. oz.

Dissolve the sulphate in the distilled water.

Solution of Opium, Compound

Liquor Opii Compositus

(Squibb's)

Deodorized Solution of Opium,	14 fl. dr.
Alcohol,	13 fl. dr.
Purified Chloroform,	1 fl. dr.
Acetic Ether,	2 fl. dr.

Mix.

Dose, 15 to 30 minims.

Solution of Potassium Permanganate

Liquor Potassii Permanganatis. U. S. 1870

Potassium Permanganate,	64 grains
Distilled Water,	16 fl. oz.

Dissolve the permanganate in the distilled water.

Solution of Phosphates

(Dr. Pepper's)

Calcium Phosphate,	6 grains
Magnesium Phosphate,	4 grains
Potassium Phosphate,	3 grains
Phosphoric Acid (Concent.),	10 minims
Water, sufficient,	
To make	2 fl. dr.

Make a solution and filter.

Solution, Ringer's

Sodium Chloride,	146 grains
Potassium Chloride,	6 grains
Calcium Chloride,	4 grains
Sodium Bicarbonate,	3 grains
Distilled Water (freshly distilled) a sufficient quantity,	
To make	33 fl. oz., 390 minims

This solution must be carefully sterilized before dispensing.

Solution of Zinc Sulphide

(Dr. Duhring's)

Zinc Sulphate,	30 grains
Potassium Sulphide,	30 grains
Alcohol,	3 fl. dr.
Rose Water,	3½ fl. oz.

Mix. Used for lupus.

Solution, Van Swieten's

Solution Antisyphilitique de Van Swieten

Liqueur d'Oxymuriate de Mercure

Corrosive Mercuric Chloride,	15 grains
Alcohol (80 per cent.),	3½ fl. oz.
Distilled Water, sufficient,	
To make	32 fl. oz.

A tablespoonful contains nearly ¼ grain of corrosive mercuric chloride.

Spirits, Bathing

(Jackson's)

Soap,	8 oz. troy
Camphor,	3 oz. troy
Oil of Rosemary,	3 fl. dr.
Oil of Thyme,	3 fl. dr.
Alcohol,	64 fl. oz.

Mix.

Spirit of Cajuput, Compound

Oil of Cajuput,	
Oil of Clove,	
Oil of Peppermint,	
Oil of Anise, of each,	4 fl. dr.
Alcohol,	2 fl. oz.

Mix. A powerful stimulant.

Starch, Iodized

AMYLUM IODATUM. U. S. 1880

Starch, 95 parts, or	418 grains
Iodine, 5 parts, or	22 grains
Distilled Water, a sufficient quantity,	
To make 100 parts, or about	1 oz. av.

Triturate the iodine with a little distilled water; add the starch gradually and continue triturating until the compound assumes a uniform blue color, approaching black. Dry it at a temperature not exceeding 40° C. (104° F.) and rub it to a fine powder.

Starch, Iodide of, Soluble

Iodine,	360 grains
Starch,	6 oz. troy
Ether,	10 fl. dr.

Dissolve the iodine in the ether, pour the solution over the starch; then triturate till the ether is evaporated; introduce into a water bath, and continue the heat for half an hour with occasional stirring. A portion of the iodine vapor has escaped, but the starch, which has now become soluble, will be combined with about 4 per cent. of iodine.

Styptic, Pancoast's

Potassium Carbonate,	120 grains
Soap,	30 grains
Alcohol,	1 fl. oz.

Mix.

Suppositories, Glycerinated Gelatin, Antiseptic

(Vaginal)

Glycerin,	90 grains
Sodium Benzoate,	10 grains
Thymol,	1 grain
Eucalyptol,	5 minims
Menthol,	3 grains
Methyl Salicylate,	10 minims
Glycerinated Gelatin, a sufficient quantity,	
To make 1 suppository (about 300 grains)	

Suppositories, Iodine and Ichthyol

(Vaginal)

Iodine,	1 grain
Potassium Iodide,	½ grain
Ichthyol,	10 grains
Glycerite of Boroglycerin,	50 grains
Glycerin,	
Sodium Borate,	5 grains
Zinc Borate,	½ grain
Tincture of Hydrastis,	5 minims
Glycerinated Gelatin, a sufficient quantity,	
To make 1 suppository (about 300 grains)	

Suppositories, Thymol

(Vaginal)

Thymol,	5 grains
Boric Acid,	10 grains
Water,	60 grains
Glycerin,	90 grains
Glycerinated Gelatin, a sufficient quantity,	
To make 1 suppository (about 300 grains)	

Rub the thymol to a fine powder, add the boric acid, then the glycerin and water. Heat the mixture with the glycerinated gelatin on a water bath until a uniform mass results.

Suppositories, Wade's

Iodoform,	60 grains
Bismuth Subnitrate,	60 grains
Hydrated Chloral,	8 grains
Morphine,	2½ grains
Oil of Rose,	10 minims
Oil of Theobroma,	240 grains

Mix, and divide into 12 suppositories one-eighth of an inch in diameter. One to be inserted into the urethra three times daily.

Syrup, Anthelmintic

Fluidextract of Senna,	1 fl. dr.
Oil of Chenopodium,	1 fl. dr.
Syrup of Rhubarb,	2 fl. oz.

Mix. Dose, a teaspoonful three times a day.

Syrup of Anthemis

Anthemis,	240 grains
Sugar,	10 oz. av.
Water,	6 fl. oz.

Make an infusion of the flowers with the water, and add the sugar, dissolving without heat.

Syrup of Asafetida

Asafetida,	240 grains
Sugar,	16 oz. av.
Boiling water,	8 fl. oz.

Rub the asafetida with part of the boiling water, until a uniform paste is made, then gradually add the rest of the water, strain, and add the sugar, using a gentle heat to dissolve it. Dose, a tablespoonful.

Syrup of Bayberry

(Thomsonian name)

Bayberry,	12 oz. troy
Sugar,	12 oz. troy
Diluted Alcohol,	64 fl. oz.

Digest the bayberry in the diluted alcohol for two days, strain, and evaporate to 16 fl. oz.; add the sugar.

Syrup of Cubeb

(Mitchell's)

Fluidextract of Cubeb,	2 fl. oz.
Magnesium Carbonate,	240 grains
Sugar,	12 oz. troy
Oil of Bitter Almond,	1 minim
Orange Flower Water,	2 fl oz.
Water, a sufficient quantity,	
To make	16 fl. oz.

Rub the fluidextract with the magnesium carbonate, and then add 2 fl. oz. of the sugar in small portions; when thoroughly mixed, add gradually first the orange flower water and then 7 fl. oz. of water, constantly triturating the mixture until the sugar is dissolved; filter, and add sufficient water to measure 11 fl. oz., in which dissolve the remainder of the sugar, without heat; add the oil dissolved in a little alcohol, and sufficient water to make 16 fl. oz.

Syrup of Ferrous Bromide

SYRUPUS FERRI BROMIDI. U. S. 1880

A syrupy liquid containing 10 per cent. of Ferrous Bromide [$FeBr_2$; 215.68].

Iron, in the form of fine wire, and cut into small pieces, 30 parts, or	1½ oz. av.
Bromine, 75 parts, or	9 fl. dr.
Sugar, in coarse powder, 600 parts, or	28 oz. av.
Distilled Water, a sufficient quantity,	
To make 1000 parts, or about	2 pints

Introduce the iron into a flask of thin glass of suitable capacity, add to it 200 parts [or

9 fl. oz.] of distilled water and afterwards the bromine. Shake the mixture occasionally, until the reaction ceases and the solution has acquired a green color and has lost the odor of bromine. Place the sugar in a porcelain capsule, and filter the solution of bromide of iron into the sugar. Rinse the flask and iron wire with 90 parts [or 4 fl. oz.] of distilled water, and pass the washings through the filter into the sugar. Stir the mixture with a porcelain or wooden spatula, heat it to the boiling point on a sand bath, and, having strained the syrup through linen into a tared bottle, add enough distilled water to make the product weigh 1000 parts [or measure 2 pints]. Lastly, shake the bottle and transfer its contents to small vials, which should be completely filled, securely corked, and kept in a place accessible to daylight.

Syrup of Galls, Aromatic

Nutgall,	240 grains
Cinnamon,	120 grains
Nutmeg,	120 grains
Glycerin,	6 fl. dr.
Syrup,	6 fl. oz.
Brandy, sufficient.	

Mix the powders, and, having moistened the mixture with a sufficient quantity of brandy, pack it firmly in a small conical glass percolator, and gradually pour brandy upon it until it commences to drop; then insert a cork tightly in the lower orifice of the percolator, and let it stand twenty-four hours; then withdraw the cork, and continue the percolation with brandy until 6 fl. oz. of tincture are obtained. Mix this with the glycerin, and evaporate by a water bath, at a temperature not exceeding 125° F., to 3 fl. oz., filter, and thoroughly mix with the syrup.

Syrup of Gillenia

Gillenia,	1 oz. troy
Sugar,	15 oz. troy
Diluted Alcohol,	8 fl. oz.
Water,	5 fl. oz.

Reduce the gillenia to a coarse powder, percolate with diluted alcohol until 8 fl. oz. are obtained, evaporate to 3 fl. oz., filter, and add sufficient water to make the liquid measure 8 fl. oz.; then add the sugar, and dissolve by a gentle heat.

Syrup of Guaiac

Guaiac (powdered),	640 grains
Potassium Hydroxide,	58 grains
Sugar,	16 oz. av.
Water, sufficient,	
To make	8 fl. oz.

Dissolve the potassium hydroxide in 8 fl. oz. of water, add the guaiac, macerate seven days, filter, add the sugar, and strain.

Syrup of Manganese Iodide

(Procter's)

Manganese Sulphate,	1 oz. troy
Potassium Iodide,	285 grains
Sugar,	6 oz. av.
Water,	
Syrup, of each, sufficient.	

Dissolve the sulphate and iodide, each, in 1½ fl. oz. of cold water, to which 1 fl. dr. of syrup has been added. Mix them in a glass stoppered bottle, and, after the crystals of potassium sulphate cease to precipitate, throw the solution on a filter of fine muslin, and allow it to pass into an 8-oz. bottle containing the sugar; add sufficient water to the filter to bring up the measure of the resulting syrup to exactly 8 fl. oz. This contains about 60 grains of the iodide to each fl. oz. Dose, 10 minims.

Syrup of Starch Iodide

Starch Iodide (soluble) (p. 1871),	360 grains
Sugar,	19 oz. troy
Water,	12 fl. oz.

Dissolve the iodide in the water, and add the sugar. This syrup contains 1 part of iodine in 1000. Dose, a teaspoonful.

Syrup of Iodohydrargyrate of Iron

Red Mercuric Iodide,	1 grain
Syrup of Ferrous Iodide,	4 fl. oz.

Mix. Dose, 20 to 30 minims, as an alterative tonic.

Syrup of Iodohydrargyrate of Potassium

Sirop Gibert

Red Mercuric Iodide,	5 grains
Potassium Iodide,	260 grains
Distilled Water,	6 fl. dr.
Syrup, sufficient,	
To make	16 fl. oz.

Dose, 1 teaspoonful.

Syrup of Juglans, Compound

Syrupus Antirhachiticus
(Vanier's)

Extract of Walnut Leaves,	152	grains
Extract of Cinchona,	75	grains
Potassium Iodide,	40	grains
Anise Oil Sugar,	115	grains
Alcohol,	2½	fl. dr.
White Wine,	4	fl. dr.
Syrup,	12	fl. oz.

Dose, for small children, a teaspoonful four to five times a day; for older children, half a tablespoonful. Vanier's syrup is said to contain, in addition to the above, 5 per cent. of cod liver oil.

Syrup, Laxative

(Amussart's)

Rasped Guaiac Wood,		
Chicory Root,		
Lappa,		
Water Dock Root,		
Fumitory Tops,		
Tops of Viola Tricolor, of each,	154	grains
Senna,	770	grains
Sugar,		
Honey, of each,	10½	oz. av.
Boiling Water, sufficient		

Bruise the materials, and infuse for twelve hours with 18 fl. oz. of boiling water; strain, and make a second infusion with 10 fl. oz. of water; strain under pressure, filter through paper (evaporate to one-fourth), then add the honey and sugar and shake until dissolved; strain. Dose, 1 to 2 tablespoonfuls a day.

Syrup of Lemon

Syrupus Limonis. U. S. 1880

Lemon Juice, recently expressed and strained, 40 parts, or	17 fl. oz.
Fresh Lemon Peel, 2 parts, or	1 oz. av.
Sugar, in coarse powder, 60 parts, or	28 oz. av.
Water, a sufficient quantity,	
To make 100 parts, or about	2 pints

Heat the lemon juice to the boiling point; then add the lemon peel, and let the whole stand, closely covered, until cold. Filter, add enough water through the filter to make the filtrate weigh 40 parts [or measure 17 fl. oz.], dissolve the sugar in the filtered liquid by agitation, without heat, and strain.

Syrup of Lobelia

(Thomsonian name)

Lobelia Seed,	1 oz. av.
Sugar,	16 oz. av.
Tincture of Lobelia,	4 fl. oz.
Vinegar,	1 fl. oz.
Water,	16 fl. oz.

Boil the seed with the vinegar and water for half an hour; add the sugar, and, lastly, when cold, add the tincture of lobelia.

Syrup of Morphine

SIROP DE MORPHINE.

Morphine Hydrochloride,	1 grain
Distilled Water,	20 minims
Syrup, sufficient,	
To make	27. fl. dr.

Mix. A tablespoonful contains about $^{1}/_{7}$ gr. morphine.

Syrup of Nickel Bromide

(Dr. Da Costa's)

Nickel Bromide,	160 grains
Glycerin,	4 fl. dr.
Sugar,	8 oz. av.
Water,	4 fl. oz.

Dissolve the nickel bromide in the water, and add the glycerin. Make a syrup by cold percolation or agitation.

Syrup of Calcium Phosphate

(Wiegand's)

Precipitated Calcium Phosphate,	1 oz. troy
Hydrochloric Acid,	4 fl. oz.
Sugar,	12 oz. troy
Water,	7 fl. oz.

Dissolve the calcium phosphate, previously mixed with an ounce of water, by means of the acid, and filter; add the sugar, then the remaining water, until the bulk is increased to 12 fl. oz., and strain. Dose, a teaspoonful.

Syrup of Manganese Phosphate

(Wiegand's)

Manganese Sulphate (cryst.),	735 grains
Sodium Phosphate,	1200 grains
Hydrochloric Acid,	4 fl. dr.
Sugar,	10 oz. troy
Water, sufficient.	

Dissolve the salts separately, each in 8 fl. oz. of water, and add the solution of sodium phosphate to the solution of manganese sulphate, as long as it produces a precipitate, which wash with cold water and dissolve by means of the acid; dilute till it measures 7 fl. oz., then add the sugar. Each fl. dr. contains 5 gr. of the salt.

Syrup of Pipsissewa

Fluidextract of Chimaphila,	4 fl. oz.
Syrup, a sufficient quantity,	
To make	16 fl. oz.

Mix.

Syrup, Strengthening

(Thomsonian name)

Comfrey Root,	2 oz. av.
Inula,	1 oz. av.
Marrubium,	240 grains
Beth Root,	120 grains
Brandy,	8 fl. oz.
Sugar,	8 oz. av.
Water,	3 pints

Add the water to the comfrey root, inula, and marrubium, and boil until the liquid measures 24 fl. oz., then strain, and add the remaining ingredients.

Syrups for Soda Water

Chocolate Syrup

Best Chocolate,	8 oz. av.
Sugar,	64 oz. av.
Water,	32 fl. oz.

Mix the chocolate in the water, and stir thoroughly over a slow fire until it boils; strain, and add the sugar.

Coffee Syrup

Mocha Coffee, pulverized,	8 oz. av.
Java Coffee, pulverized,	8 oz. av.
Sugar,	6½ ℔ av.
Glycerin,	
Water, each, a sufficient quantity,	
To make	1 gal.

Moisten the coffee with a menstruum of water containing 10 per cent. of glycerin. Pack in a percolator and percolate with enough of the above menstruum to obtain 64 fl. oz. of percolate. Add the sugar to the percolate, dissolve it by agitation, without the aid of heat, and strain.

Vanilla Syrup

Tincture of Vanilla,	2 fl. dr.
Syrup, a sufficient quantity,	
To make	32 fl. oz.

Mix.

"Syrup" of Terebene

Terebene,	320 minims
Acacia, powdered,	½ oz. troy
Flavored Syrup,	16 fl. oz.

Pour the terebene in a dry pint bottle and add the powdered acacia; shake them well together and add the flavored syrup, agitating until well mixed. Shake when dispensing, and place a "shake" label on the bottle.

Tea, Tonic

(Gerhard's)

Gentian,	1 oz. troy
Rhubarb,	120 grains
Ginger,	240 grains
Sodium Bicarbonate,	120 grains
Boiling Water,	32 fl. oz.

Bruise the gentian, rhubarb, and ginger, mix them, and add the sodium bicarbonate; then infuse in 32 fl. oz. of boiling water. Dose, a wineglassful three times a day.

Tea, Worm

Spigelia,	240 grains
Manna,	240 grains
Senna,	120 grains
Fennel,	60 grains

Contuse the Spigelia and mix it with the other ingredients; infuse in 16 fl. oz. of boiling water. Give a child, two years old or upward, half a teacupful, warm, morning, noon, and night, before eating.

Third Preparation

(Thomsonian name)

Lobelia Seed,	
Capsicum, of each,	1 oz. av.
Cypripedium Powder,	10 grains

Add 12 fl. oz. of Number Six (page 499), macerate, and keep on the dregs.

Tincture, Asiatic

(For cholera)

Opium,	240 grains
Camphor,	240 grains
Capsicum,	240 grains
Oil of Clove,	4 fl. dr.
Compound Spirit of Ether,	8 fl. oz.

Macerate from ten to twenty days, or prepare by percolation in a close percolator. Dose, 20 to 60 drops every second, third, or fourth hour in sweetened water.

Tincture, Astringent

AROMATIC TINCTURE OF GALLS

(Gilbert's)

Nutgall,	16 oz. av.
Oil of Citron,	30 minims
Oil of Bergamot,	30 minims
Oil of Lemon,	30 minims
Oil of Thyme,	8 minims
Oil of Lavender,	8 minims
Oil of Rosemary,	8 minims
Tincture of Benzoin,	1 fl. dr.
Alcohol (90 per cent.), sufficient.	

Exhaust the nut gall by percolation with alcohol, distil off the alcohol, and evaporate to 8 fl. oz.; redissolve this extract in 8 fl. oz. of alcohol, add the oils, and filter.

Tincture of Black Hellebore

TINCTURA HELLEBORI. U. S., 1870

Black Hellebore, in moderately fine powder,	4 oz. troy
Diluted Alcohol, a sufficient quantity.	

Moisten the powder with 1 fl. oz. of diluted alcohol, pack it in a cylindrical percolator, and gradually pour diluted alcohol upon it until 2 pints of tincture are obtained.

Tincture of Burdock Seed

Ground Burdock Seed,	4 oz. troy
Water,	4 fl. oz.
Alcohol,	12 fl. oz.

Mix the liquids, and percolate in the usual way until 16 fl. oz. of tincture are obtained. Dose, a teaspoonful three or four times a day.

Tincture of Cannabis Indica, Ethereal

Extract of Cannabis,	240 grains
Spirit of Nitrous Ether,	8 fl. oz.

Triturate together in a mortar till the extract is dissolved. Dose, five to fifteen drops.

Tincture of Cantharides, Ethereal

Cantharides,	1 oz. troy
Spirit of Nitrous Ether,	14 fl. oz.

Macerate for eight days, and filter.

Tincture of Castor

TINCTURA CASTOREI. U. S. 1870

Castor (bruised),	1 oz. troy
Alcohol,	16 fl. oz.

Macerate for seven days, express, and filter through paper.

Tincture of Colchicum, Ethereal

Colchicum,	3 oz. troy
Spirit of Nitrous Ether, sufficient	
To make	8 fl. oz.

Made by percolation. Dose, twenty to thirty drops.

Tincture of Conium

TINCTURA CONII. U. S. 1880

Conium in No. 30 powder, 150 parts, or	4¾ oz. av.
Diluted Hydrochloric Acid, 4 parts, or	1 fl. dr.
Diluted Alcohol, a sufficient quantity,	
To make 1000 parts, or	2 pints

Moisten the powder with 45 parts [or 2 fl. oz.] of diluted alcohol, previously mixed with the diluted hydrochloric acid, and macerate for twenty-four hours; then pack it moderately in a conical glass percolator, and gradually pour diluted alcohol upon it, until 1000 parts [or 2 pints] of tincture are obtained.

Tincture of Cubeb, Ethereal

Cubeb,	2 oz. troy
Spirit of Nitrous Ether,	16 fl. oz.

Macerate for eight days, and filter.

Tincture of Ferric Acetate. Tincture of Acetate of Iron

TINCTURA FERRI ACETATIS. U. S. 1880

Solution of Acetate of Iron, 50 parts, or	4 fl. oz.
Alcohol, 30 parts, or	3 fl. oz. 3 fl. dr.
Acetic Ether, 20 parts, or	2 fl. oz.
To make 100 parts, or	9 fl. oz.

Mix the alcohol and acetic ether, and gradually add the solution of acetate of iron, taking care that the mixture remains cool. Keep the tincture in glass-stoppered bottles, in a cool and dark place.

Tincture, Golden

Ether,	2 fl. oz.
Tincture of Opium,	2 fl. oz.
Chloroform,	4 fl. dr.
Alcohol,	2 fl. oz.

Mix. Dose, three to twenty drops.

Tincture of Green Soap, Compound

(Tilbury Fox)

Green Soap,	1 oz. troy
Oil of Lavender,	90 minims
Oil of Cade,	
Alcohol, of each,	1 fl. oz.

Mix.

Tincture of Green Soap with Tar

(Hebra's)

Green Soap,	1 oz. troy
Tar,	
Alcohol, of each,	1 fl. oz.

Tincture of Guaiac, Ethereal

Guaiac,	1½ oz. troy
Spirit of Nitrous Ether,	8 fl. oz.

Make by maceration. Dose, a teaspoonful.

Tincture of Ignatia, Compound

GOUTTES AMÈRES. BITTER DROP

Ignatia,	8 oz. troy
Alcohol, 60 per cent.,	16 oz. (by weight)
Potassium Carbonate,	30 grains
Charcoal,	6 grains
Oil of Wormwood,	6 fl. dr.

Macerate fifteen days, and then recover 16 fl. oz. by percolation.

Tincture of Iodine, Ethereal

(Magendie's)

Iodine,	32 grains
Ether,	1 fl. oz.

Dissolve. Used externally.

Tincture of Iodoform, Compound

Iodoform,	15 grains
Potassium Iodide,	120 grains
Glycerin,	2 fl. dr.
Alcohol,	6 fl. dr.

Rub the iodoform and the potassium iodide in a mortar until a fine powder is produced, then add the glycerin and rub to the consistency of cream; then add the alcohol, and stir briskly until all is dissolved. Dose, fifteen drops three times a day, on sugar or in syrup.

Tincture of Iron, Bitter

(Physick's)

Iron (filings),	3 oz. av.
Ginger (bruised),	
Gentian (bruised), of each,	1 oz. av.
Orange Peel,	½ oz. av.
Strong Old Cider,	16 fl. oz.

Macerate for two weeks or longer, express, and filter.

Tincture of Lupulin

Tinctura Lupulinæ. U. S. 1870

Lupulin,	4 oz. troy
Alcohol, a sufficient quantity.	

Pack the lupulin in a narrow cylindrical percolator, and gradually pour alcohol upon it until 32 fl. oz. of tincture are obtained.

Tincture of Opium, Acetated

Tinctura Opii Acetata. U. S. 1870

Powdered Opium,	2 oz. troy
Distilled Vinegar,	12 fl. oz.
Alcohol,	8 fl. oz.

Macerate for a week, express, and filter.

Tincture, Purgative

(Dobell's)

Resin of Podophyllum,	8 grains
Tincture of Ginger,	5 fl. dr.
Alcohol,	8 fl. dr.

Mix. Dose, a teaspoonful at night, when lying down.

Tincture of Rhubarb and Senna

Tinctura Rhei et Sennæ. U. S. 1870

(Warner's Gout Cordial)

Rhubarb,	1 oz. troy
Senna,	120 grains
Coriander,	
Fennel, of each,	60 grains
Glycyrrhiza,	30 grains
Raisins, deprived of their seeds,	6 oz. troy
Diluted Alcohol,	48 fl. oz.

Macerate for seven days, express, and filter through paper.

Tincture, Stavesacre

Stavesacre, ground,	7 oz. av. 24 grains
Alcohol, a sufficient quantity,	
To make	33 fl. oz. 390 minims

Macerate the stavesacre with 150 mils of alcohol for twenty-four hours, then pack firmly in a cylindrical percolator and continue passing alcohol through the ground drug until the percolate measures 33 fl. oz. 390 minims.

Tonic, Hair

(Prof. Gross)

Tincture of Cantharides,	90 minims
Tincture of Capsicum,	20 minims
Glycerin,	30 minims
Perfumed Spirit, sufficient,	
To make	6 fl. oz.

Mix.

Troches of Borax

Sodium Borate,	150 grains
Powdered Sugar,	1800 grains
Carmine, No. 40,	1½ grains
Tragacanth (in flakes),	5 grains
Distilled Water,	120 minims
Tincture of Benzoin,	20 minims

Prepare a mucilage from the tragacanth, with the addition of the water and tincture. Dissolve the carmine in 30 minims of ammonia water. Mix the dry ingredients together, add the carmine solution and sufficient tragacanth mucilage to form a mass. Divide the mass into 100 troches, each weighing 20 grains and containing 1½ grains of sodium borate.

Troches of Magnesia

Trochisci Magnesiæ. U. S. 1880

Magnesium Oxide,	300 grains
Nutmeg, in fine powder,	15 grains
Sugar, in fine powder,	900 grains
Mucilage of Tragacanth, a sufficient quantity,	
To make	100 troches

Rub the magnesium oxide and the powders together until they are thoroughly mixed; then, with mucilage of tragacanth, form a mass, to be divided into 100 troches.

Vinegar of Lobelia

Acetum Lobeliæ. U. S. 1880

Lobelia, in No. 30 powder, ten parts, or	1¾ oz. av.
Diluted Acetic Acid, a sufficient quantity,	
To make 100 parts, or	1 pint

Moisten the powder with 5 parts [or 1 fl. oz.] of diluted acetic acid, pack it firmly in a conical glass percolator, and gradually pour diluted acetic acid upon it until 100 parts [or 1 pint] of filtered liquid are obtained.

Vinegar, Raspberry

Raspberry Syrup,	16 fl. oz.
Glacial Acetic Acid,	1 fl. dr.

Mix. Dilute with sufficient water.

Vinegar of Sanguinaria

Acetum Sanguinariæ. U. S. 1880

Sanguinaria, in No. 30 powder, 10 parts, or	1¾ oz. av.
Diluted Acetic Acid, a sufficient quantity,	
To make 100 parts, or	1 pint

Moisten the powder with 5 parts [or 1 fl. oz.] of diluted acetic acid, pack it firmly in a conical glass percolator, and gradually pour diluted acetic acid upon it until 100 parts [or 1 pint] of filtered liquid are obtained.

Weed Killers

I

Ferrous Sulphate,	75 parts
Ammonium Sulphate,	15 parts
Fine Sand,	10 parts

Mix together and sift. In dry weather from 3 to 4 ounces may be spread over each square yard of lawn.

II

Sodium Chloride,	3 ℔
Chrome Alum,	2 ℔
Water,	15 gals.

Mix.

Wine of Aloes

Vinum Aloes. U. S. 1880

Purified Aloes, 6 parts, or	2 oz. av.
Cardamom, 1 part, or	146 grains
Ginger, 1 part, or	146 grains
Stronger White Wine, a sufficient quantity,	
To make 100 parts, or	2 pints

Mix the aloes, cardamom, and ginger, and reduce them to a moderately coarse (No. 40) powder. Macerate the powder with 90 parts [or 26 fl. oz.] of stronger white wine for 7 days, with occasional agitation, and filter through paper; adding, through the filter, enough stronger white wine to make the filtered liquid weigh 100 parts [or measure 2 pints].

Wine, Aromatic

Vinum Aromaticum. U. S. 1880

Lavender, 1 part, or	72 grains
Origanum, 1 part, or	72 grains
Peppermint, 1 part, or	72 grains
Rosemary, 1 part, or	72 grains
Sage, 1 part, or	72 grains
Wormwood, 1 part, or	72 grains
Stronger White Wine, a sufficient quantity,	
To make 100 parts, or	1 pint

Mix the solid ingredients, and reduce them to a coarse (No. 20) powder. Moisten the powder with 4 parts [or 6 fl. dr.] of stronger white wine, pack it moderately in a conical glass percolator, and gradually pour enough stronger white wine upon it to make the filtered liquid weigh 100 parts [or measure 1 pint].

Wine of Rhubarb

Vinum Rhei. U. S. 1880

Rhubarb, in No. 30 powder, 10 parts, or	3¼ oz. av.
Calamus, in No. 30 powder, 1 part, or	140 grains
Stronger White Wine, a sufficient quantity,	
To make 100 parts, or	2 pints

Moisten the mixed powders with 5 parts [or 1½ fl. oz.] of stronger white wine, pack the mixture in a conical glass percolator, and gradually pour enough stronger white wine upon it to make the filtered liquid weigh 100 parts [or measure 2 pints].

Wine of Tobacco

Vinum Tabaci. U. S. 1870

Tobacco,	240 grains
White Wine,	8 fl. oz.

Macerate and filter.

GLOSSARY

OF

UNCOMMON NAMES, TERMS, OR SUBSTANCES

A.

Acetum Acerrimum. Concentrated acetic acid.

Bezoardicum. Aromatic vinegar.

Saturni. Solution of lead subacetate.

Theriacale. Aromatic vinegar.

Acetylphenylamine. Acetanilid, *U. S. P.*

Acid, Anticyclic. Mixture of antipyrin and salicylic acid.

Boroboracic (Acid Boroboric). Mixture of equal parts of borax and boric acid.

Borussic. Prussic. Hydrocyanic.

Carbazotic (Picronitric acid). Picric acid.

Coalic. Obtained by treating coal with 34 per cent. nitric acid.

Cresylic. Cresol.

Nancic. Lactic acid.

Phenic. Carbolic acid.

Sozoiodolic. Diiodoparaphenolsulphonic acid. (Antiseptic.)

Sozolic. Orthophenolsulphonic acid.

Sulphhydric. Hydrogen sulphide. Sulphuretted hydrogen. Hydrosulphuric acid.

Thiolinic. Sulphurated and sulphonated linseed oil.

Tumenolsulphonic. Obtained by treating the distillate of a mineral oil with sulphuric acid.

Acidum Asepticum (Acidum Aseptinicum). Mixture of solution of hydrogen peroxide with boric and salicylic acids.

Chloronitrosum. Nitrohydrochloric acid.

Cœruleum (Blue acid). Hydrocyanic acid.

Muriaticum Oxygenatum. Chlorine.

Nitrico-Nitrosum. Fuming nitric acid.

Ossium. Glacial phosphoric acid.

Scytodepsicum. Tannic acid.

Actina. Contains menthol, oil of mustard, and ether.

Adeps Anserinus. Goose-grease.

Gadi. Cod-liver oil.

Lanæ. Lanolin (purified wool-fat).

Ovillus. Mutton-suet.

Adipatum. Substitute for lard; a mixture of lanolin, vaselin, and ceresin.

Adragante. Tragacanth.

Aer Fixus. Carbonic acid gas.

Aerosus Lapis. Lapis calaminaris.

Aerozol. Ozonized volatile oils. (Ozone Co., New York.)

Ærugo. Crude copper acetate.

Æs. Copper.

Æs Aratum. Copperas.

Æther Vegetabilis. Acetic ether.

Ætheroleum. Volatile (essential) oil.

Æthiops Antimonialis. Chiefly a mixture of black antimony and mercury.

Martialis. A black iron oxide; formed by keeping iron filings covered with water for a long time.

Mineralis. Mixture of mercury and sulphur.

per se. Mercury oxide.

Vegetabilis. Charcoal of sea-weed.

Affium. Extract of poppy-heads (opium).

Agathin. Salicylalphamethylphenylhydrazone. (Anodyne.)

Agnine. Lanolin without the water. (Metcalf & Co., Boston.)

Agopyrin. Said to be a mixture of salipyrin, ammonium chloride, and cinchonine sulphate. (Influenza remedy.)

Alabastine. An improved kalsomine.

Alanin-Mercury. Mercury amidopropionate.

Alboline. A purified petroleum product, similar to white vaselin. (McKesson & Robbins.)

Album Græcum. Excrement of dogs.

Nigrum. Excrement of mice or rats.

Alcohol Sulphuris. Carbon disulphide.

Alcolene. A mixture of ethyl and methyl alcohols.

Alcoolat (French). A distilled spirit.

Alcoolature (French). An alcoholic tincture of a fresh plant. ("Green tinctures.")

Alcoolé (French). An alcoholic solution of a substance entirely soluble in the alcohol.

Alegar. Ale vinegar. (Made by fermenting ale upon raisins or vine cuttings.)

Alexine. A generic name for protective albuminous preparations used for inoculations.

Algaroth. Antimony oxychloride.

Alkali, Vegetable. Potassium carbonate.

Volatile. Ammonium carbonate.

Alkalithia. Contains caffeine, sodium, and potassium bicarbonates, and lithium carbonate. (Specialty of Keasbey & Mattison.)

Alkathrepta. A homœopathic preparation of cacao.

Almond Bran. A cosmetic powder for washing, consisting of perfumed powdered almonds and borax.

Alum, Rock (Alumen Rupeum). Lump alum as it occurs with the earth attached.

Roman. See Rock Alum.

Alumen Plumosum. Asbestos.

Alumnol. Aluminum salt of oxymethylsulphonic acid. Aluminum naphtol sulfonate. (Astringent antiseptic.)

Amadou. Punk; tinder.

Ambretta Seeds. Musk seeds.

Amianthus. Asbestos.

Amidol. Diamidophenol (for photographic purposes).

Amidum. Starch.

Ammonium Carbonicum Pyro-Oleosum. A mixture of ammonium carbonate with "animal oil."

Sulpho-Ichthyolate. Ichthyol.

Amphion. Opium.

Amplosia. An unfermented juice of the grape.

Amylopsin. Starch-converting ferment of the pancreatic juice.

Analgene. An antineuralgic and anodyne. Orthoexethylalphamonoacetylamidochinoline. Orthoöxyethylanamonobenzoylamidoquinoline.

Analgesine. Antipyrin.

Anaphromeli. Clarified honey (Mel despumatum).

Anaspalin. Ointment base, similar to lanolin.

Angioneurosin. Nitroglycerin.

Anima Articulorum (Life of the Limbs). A name given to colchicum.

Rhei. Aqueous tincture of rhubarb.

Annidalin. Aristol. (Antiseptic.)

Anodynin. Antipyrin.

Antacidines. Lime-water tablets. (Metcalf & Co., Boston.)

Anthos (Flores or Herba). Rosemary (flowers or herb).

Anthrakokali. Coal treated with caustic potassa.

Anthrarobine. Dioxyanthranol. Leucoalizarin. (Antiseptic dermic.)

Antibacteride. A mixture of borax, boric acid, and glucose.

Anticholerine. A product of cholera bacteria, according to Klebs.

Antidiphtherine. Potassium chlorate with a trace of iron chloride.

Antidotum Fuchsi. Fluid ferric hydrate. (Arsenic antidote.)

Antifebrin. Acetanilid, *U. S. P.* Acetylphenylamine. Phenylacetamide.

Antifungin. Antiseptic. Contains magnesium biborate and free boric acid.

Antikamnia. An anodyne. Said to be a mixture of antifebrin, sodium bicarbonate (with or without caffeine), and tartaric acid. (Anodyne, antipyretic.)

Antikol. Mixture of acetanilid, sodium bicarbonate, and tartaric acid.

Antimonium Album. Bismuth.

Antimony, Diaphoretic. Potassium antimonate.

Antinervine. Salicyl-bromanilid. Said to be a mixture of acetanilid, ammonium bromide, and salicylic acid. (Sedative.)

Antinonnine. Potassium orthodinitrocresol with soap and glycerin. (Parasiticide.)

Antipyrin. Analgesine. Anodynine. Dimethyloxychinozin. Parodyn. Metosin. Phenazon. Phenylon. Phenyldimethylpyrazolon. Pyracin. Phenyldimethylisopyrazolon. Pyrazolon. Oxydimethyl-chinizin. Sedatin. Oxydiëthylquinizine.

Antisepsin. Monobromacetanilid. Paramonobromphenylacetamide.

Antiseptin. Mixture of zinc iodide and sulphate with boric acid and thymol.

Antiseptol. Cinchonine iodosulphate. (Antiseptic.)

Antithermal. A new antipyretic of unknown composition.

Antithermin. Phenylhydrazine-lævulinic acid. (Antipyretic.)

Antlia Gastrica. Stomach-pump.

Apioline. Chapoteau's specialty; active principle of parsley.

Apone. Liniment. (Capsicum, ammonia, chloral.)

Apyonin. French designation for yellow pyoktanin. (Antiseptic.)

Apyrothium. Sulphur.

Aqua Binelli. Creosote water.

Bullientis (Aquæ). Boiling water.

Cerasorum. Diluted bitter almond water.

Crotonis. Water from Croton Lake, New York (that is, hydrant water).

Flava. Yellow wash.

Fœtida Antihysterica. A distillate from asafetida, galbanum, myrrh, valerian, etc.

Fortis. Nitric acid.

Aqua Gummosa. Diluted mucilage of gum arabic (about 1 part of gum in 64 of water).

Hydrothionica. Sulphuretted hydrogen water.

Laxativa Viennensis. Compound infusion of senna. (Modified black draught.)

Metallorum. Mercury.

Naphæ. Orange flower water.

Nigra. Black wash.

Phagedænica. Yellow wash.

Regis. Nitrohydrochloric acid.

Saturnina. Lead water.

Vitæ. Brandy or whiskey.

Aquila Alba. Calomel.

Aquozon. Ozonized water. (Ozone Co., New York.)

Argentum Fugitivum. Quicksilver.

Musivum. Mosaic gold.

Vivum. Quicksilver.

Argilla. Clay. (In pharmacy it means alumina.)

Sulphurica Alcalisata. Alum.

Argols. Crude potassium bitartrate.

Aristol. Dithymoldiiodide. Di-iododithymol. (Antiseptic.)

Arquebusade. An agreeably smelling vulnerary water, which might be called "compound sage water."

Asa Dulcis. Benzoin.

Asaprol. Calcium salt of betanaphtol-alphamonosulphonic acid. (Antiseptic.)

Asbolin. An alcoholic distillate of soot. (Antitubercular.)

Asepsin. Antisepsin.

Aseptin. Mixture of boric acid, borax, and alum.

Aseptol. Sozolic acid. Orthophenylsulphonic acid (33 per cent. aqueous solution).

Asparoline. Contains guaiacum, asparagin, parsley seed, black haw, and hyoscyamus. (According to Wampole & Co., Philadelphia.)

Ater (Atra). Black (Niger).

Atramentum. Black ink.

Indicum (Sinense). India ink.

Auramin. Yellow pyoktanin. (Antiseptic.)

Aureoline. Hair bleach. (A more or less diluted solution of hydrogen peroxide.)

Aurum Musivum (Mosaic Gold). Tin bisulphide.

Axungia. Adeps. (Fat.)

B.

Baker's Salt. Ammonium subcarbonate.

Balata. Gum chicle.

Balsam, Friar's. Compound tincture of benzoin.

Balsam, Hungarian. Exudation from Pinus pumilio.

Persian. Compound tincture of benzoin.

Riga. By distillation from the leaves of Pinus cembra; generally an artificial aromatic spirit.

Sulphur. Sulphurated linseed oil.

Traumatic. Compound tincture of benzoin.

Balsamum Arcæi. An ointment of elemi.

Gileadense. Balm of Gilead.

Judaicum. Balm of Gilead.

Nucistæ. An ointment containing the volatile and fixed oils of nutmeg.

Ophthalmicum Rubrum. Ointment of red precipitate.

Saponaceum. Opodeldoc.

St. Yves. Ointment of red precipitate.

Universale. Ointment of lead subacetate, made with yellow wax and rape-seed oil.

Verum. Balm of Gilead.

Vitæ Hoffmanni. Alcoholic solution of sundry balsamic oils.

Bang. Cannabis Indica.

Barbotine. See Semen Contra.

Barilla. Impure sodium carbonate.

Barm. Yeast.

Baudruche. Goldbeaters' skin.

Baume de Vie. Compound decoction of aloes.

Tranquille. Compound infused oil of hyoscyamus.

Belle Dame. Atropa belladonna.

Benedictum Vinum. Antimonial wine.

Benzene. Of English chemists, means benzol (coal-tar benzin), and not the American benzin (from petroleum).

Benzoic Ether. Ethyl benzoate.

Benzonaphtol. Betanaphthylbenzoate. Betanaphtol-benzoate. (Intestinal antiseptic.)

Benzophenoneid. Apyonin (yellow pyoktanin).

Benzosol Benzoyl-guaiacol. Guaiacol benzoate (Antitubercular.)

Betel Nut. Areca nut.

Betol. Betanaphthyl salicylate. Betanaphtol salicylate. (Intestinal antiseptic.)

Big "G." Injection. Contains borax and berberine.

Bilis Bovinum. Ox's gall.

Bi-Palatinoid. Gelatin capsule divided by a partition, to keep two powders separate until swallowed.

Bitumen Judaicum. Asphaltum.

Black Draught. A compound infusion of senna; must not be confounded with "Black Drop."

Black Drop. Vinegar of opium.

Black Flux. A mixture of charcoal and potassium carbonate.

Blanc Fixe. Artificial barium carbonate or sulphate.

Blue, Berlin. Prussian blue.

Black. A name for ivory-black.

Chinese. Prussian blue.

Bolus Armena. Bole Armenian.

Borofax. Trade-mark applied to an emollient by Burroughs, Wellcome & Co.

Boroglycerin. A concentrated solution of boric acid in glycerin.

Borol. Fused mixture of boric acid and sodium bisulphate.

Borussic. Prussian. Hydrocyanic.

Bovinine. Meat juice preserved by glycerin and boric acid.

Bovox. An essence of beef. (Boston.)

Bovril. Extract of beef, peptone, albumen, and fibrin. (London.)

Brain Salt, Effervescent. Contains chiefly ammonium bromide and caffeine.

Brasium. Malt.

British Gum. Dextrin.

Brofeine. Specialty of Wohlfarth, New York.

Bromo-Febrin. Said to be potassium or ammonium bromide and antifebrin. (Specialty of Weiller & Co., Baltimore.)

Bromo-Caffeine. Specialty of Keasbey & Mattison, Ambler, Pa.

Bromo-Pyrene. Specialty of Wampole, Philadelphia.

Bromo-Soda. Specialty of Warner & Co., Philadelphia.

Bromol. Tribromophenol. (Antiseptic.)

Brotipyrine. Specialty of Stearns & Co., Detroit.

Burning Fluid. Three measures of alcohol and one of purified oil of turpentine.

Butter of Antimony. Solution of antimony chloride.

Butylhypnal. Butylchloral-antipyrin.

Butyrum Majoranæ. Ointment of sweet marjoram.

Nucistæ. Expressed oil of nutmeg.

Byne (Bynin). Apparently a favorite name in England for malt and malted preparations.

Bynol. Malt and cod-liver oil. (Allen & Hanbury, London.)

C.

C. See also K.

Cactina. A preparation of Cactus grandiflorus. (Sultan Co., St. Louis.)

Caffa. Camphor.

Caffeoresorcin. Combination of caffeine with resorcin.

Cail-Cedra. Bark of Swietenia senegalensis.

Calamine. Impure zinc carbonate.

Calcithos. Copper subacetate.

Calisaya. Cinchona (Yellow).

Camphine. Rectified oil of turpentine.

Camphoid. Gun-cotton dissolved in an alcoholic solution of camphor. 1 : 20 solution of pyroxylin in Rubini's camphor solution. (Vehicle for dermics.)

Camphol. A mixture of camphor and salol. (Antiseptic.)

Camphor Julep. Camphor mixture.

Camphorline. A trade name for naphtalin.

Cancroin. Extract of cancerous tumors, according to Adamkiewicz. (Alexine of cancer.)

Cancrorum Lapilli. Crabs' stones.

Chelæ. Crabs' claws.

Candelæ Fumales. Fumigating pastilles.

Canthos. A special cantharidal plaster of Johnson & Johnson, London.

Capita Papaveris. Poppy-heads.

Capsulæ Amylaceæ. Wafer capsules.

Carbasus. Gauze.

Carboline. A hair preparation. Perfumed liquid vaselin.

Carbon Black. The soot of natural gas.

Carnine Syrup, Niemann's. Beef juice preserved by cane sugar.

Cassius's Purple. A compound of tin with gold oxide.

Castoria. A laxative. Said to be a modified compound infusion of senna.

Celerina. Said to be a combination of celery, black haw, coca, and probably kola.

Cera Sigillata. Sealing-wax.

Cerate, Compound Camphor. Camphor ice.

Ceratum Citrini (P. L. 1745). Resin cerate.

Epuloticum (P. L. 1745). Ceratum calaminaris. Turner's cerate.

Labiale. Lip salve.

Lithargyri Acetati Compositum. Goulard's cerate. (P. L. 1787.)

Cerate, Turner's. Cerate of calamine.

Ceresin. Earth-wax. An impure paraffin.

Cetraria. Iceland Moss.

Chalcanthum. Copperas.

Charpie. Lint.

Chelen (Kelene). Ethyl chloride. (Local anæsthetic.)

Chemical Food. Compound syrup of phosphates.

Chinium. Quinine.

Chionia. A preparation of Chionanthus. (Peacock Co., St. Louis.)

Chloral Caffeine. Molecular combination (1 : 1) of chloral and caffeine. (Anodyne, antispasmodic.)

Camphor. A mixture of chloral and camphor.

Chloral Carmine. Staining fluid. Heat 0.05 Gm. carmine, 20 mils dehydrated alcohol and 30 drops HCl (sp. gr. 1.124) for half an hour on water bath, add 25 Gm. hydrated chloral, and filter.

Chloralamide. Chloral formamide.

Chloralimide. Trichlorethylidenimide.

Chlorobrom. Solution of potassium bromide and chloralamide in water.

Chlorol. Solution of corrosive sublimate, sodium chloride, hydrochloric acid and copper sulphate in water. (Antiseptic.)

Chlorophenol. Antiseptic.

Christia. Manila paper made waterproof with chrome gelatin.

Chymosin. Pepsin.

Cibus Deorum. Asafetida.

Cineres Clavellati. Crude potassium carbonate.

Cinnabar (Vermilion). Mercuric sulphide.

Coal-Tar Naphtha. Benzol.

Cognac. Brandy.

Colcothar. Crude ferric oxide.

Colla Piscium. Isinglass.

Conchinine (of the German chemists). Quinidine.

Condy's Fluid. A solution of potassium permanganate similar to Liquor Potassii Permanganas B. P., containing 1 per cent. of the salt in aqueous solution.

Confectio Cardiaca. Aromatic confection.

  Damocratis. *Damocrates' confection.* An aromatic astringent confection containing opium. Originally it contained 64 ingredients.

Connecticut Lead. Barytes.

Cornu Cervi. Hart's horn. Ammonium carbonate.

  Cervi Ustum Nigrum. Bone-black.

Cream of Tartar, Soluble. Potassium and sodium borotartrate.

Cremor Antisepticus. Chiefly vaselin and thymol. (London.)

Creolin. Mixture of coal-tar hydrocarbons with resin soap (Pearson's), or with cresolsulphonic acid (Artmann's creolin).

Creosotal. Creosote Carbonate.

Creosote Carbonate. Chiefly an impure guaiacol carbonate.

Cresalol. Paracresol salicylate. Paracresylic ether of salicylic acid. (Intestinal antiseptic.)

Cresol. Cresylic acid.

Cresolin. A preparation similar to creolin.

Cresylol. Cresol. Cresylic acid. Metacresol. (Antiseptic.)

Crocus Martis. Ferric oxide.

  Metallorum (**Antimonii**). Brown antimony oxide.

  Saturni. Red lead.

Croton-Chloral. Butyl-chloral.

Cryst Alba. Refined naphtalene. (Disinfectant.)

Crystalli Tartari. Cream of tartar.

Cuca. Coca.

Cullet. Broken glass for remelting.

Cuprum Scoriatum. Crude copper acetate. (Verdigris.)

Curaçao. Elixir of orange peel.

Cutch. Dark (black) gum catechu.

Cynosbatæ. See Hips.

D.

Dactyli. Dates.

Dagutt. See Daggett, Oil of.

Dasjespis. Inspissated urine of the South African badger (Hyrax).

Decoctum Album. A kind of chalk mixture.

  Diaphoreticum. Compound decoction of guaiacum.

  Lignorum. Compound decoction of guaiacum wood.

  Zitmanni. Compound decoction of sarsaparilla.

Dermatol. Bismuth subgallate. (Astringent antiseptic.)

Derosne's Salt. Narcotine.

Diabolus Metallorum. Tin.

Diacodium. Poppy-heads. (Old name for syrup of poppies.)

Diagrydium. Scammony.

Diana. Silver.

Diapente. A tonic powder, or electuary, composed of 5 ingredients.

Diaphtherin. Oxychinaseptol. (Oxychinolin and orthosulphonic acid.) Orthophenol sulphonate. (Antiseptic.)

Diascordium. An aromatic electuary of tormentil root and scordium (water germander) with opium.

Dilapsus. As an adjective to several salts means effloresced.

Dimethyl-oxy-chinizin. Antipyrin.

Disinfectant, Jeye's. Mixture of coal-tar hydrocarbons with resin soap.

  Ledoyen's. Solution of lead nitrate.

Disinfectol. A product similar to creolin.

Dithione. Mixture of the sodium salts of the isomers of dithiosalicylic acid. (Antirheumatic.)

Diuretin ("**I. & II.**"). Theobromine sodium salicylate. (Diuretic.)

Draco Mitigatus. Calomel.

Dulcin. A new sweetening agent. Paraphenetolcarbamid. (Sucrol.)

Dutch Drops. Haarlem oil.

  Liquid. } The chloride of olefiant gas.
  Oil. }

  Tea. A variety of St. Germain tea. (Laurent.)

E.

Earth, Japan. Catechu.

Nut. Peanut.

Eau de Rabel. See Elixir, Haller's.

Sédative de Raspail. Contains ammonia, salt, camphor, alcohol, and water.

Ebur Ustum. Boneblack.

Eikonogen. Sodium salt of the amidobetanaphtolbetamonosulphonic acid. (For photographic purposes.)

Elæosaccharum. Oil sugar. (Sugar flavored with volatile oil.)

Electuarium. Confection. (Soft.)

Dentifricium. Tooth paste.

Elephant Louse. The nut of cashew.

Eliteine. Specialty of Ingram, Detroit, Mich. (Skin lotion.)

Elixir Adjuvans. The U. S. P. elixir of glycyrrhiza.

Anisi. Aniseed cordial.

Aperitivum. Compound tincture of aloes.

Aurantiorum Compositum. A compound elixir of orange peel and gentian.

of the Three Chlorides. Contains iron, mercury, and arsenic, with elixir cinchona. (Renz & Henry, St. Louis.)

Corrigens. Aromatic elixir of yerba santa.

Daffy's. Compound tincture of senna.

Garus. Mixture of syrup with an alcoholic distillate of aloes and spices.

Haller's. 3 parts alcohol and 1 part sulphuric acid, mixed slowly.

of Long Life. A modification of the well-known Swedish Bitters.

ad Longam Vitam. Elixir of Long Life.

Nutrans. Tonic. (Allaire, Woodward & Co., Peoria, Illinois.)

Pectorale. Compound ammoniated elixir of liquorice with oils of fennel and anise.

Proprietatis (Paracelsi). Compound tincture of aloes and myrrh.

Purgans. Compound tincture of jalap.

Rhei Darelii. Tinctura rhei dulcis.

Roborans Whyttii. Compound tincture of cinchona (containing saffron).

Salutis. Compound tincture of senna.

Stomachic. }
Stoughton's. } Compound tincture of gentian.

Viscerale. Compound tincture of orange peel and gentian.

Vitrioli Mynsichti. Aromatic sulphuric acid.

Emplastrum Cantharidum Perpetuum. A mild cantharidal plaster.

Fuscum. Mother plaster. Universal plaster. Brown salve.

Gummosum. Compound plaster of galbanum.

Ens Martis. Ammoniated iron.

Enule. Trade-mark suppositories, Burroughs, Wellcome & Co.

Epidermine. Ointment basis, consisting of white wax, water, gum, and glycerin, equal parts.

Ergotole. Specialty of Sharp & Dohme, Baltimore.

Eserine. Physostigmine.

Essence (French). Volatile oil.

of Mirbane. Nitrobenzol. (Artificial oil of bitter almonds.)

Éthérolat, Éthérolaturé, Éthérolé (French). Correspond to the alcoholic terms. (See Alcoolat, etc.)

Ethyl Bromide. Monobrom-ethane. Must not be confounded with ethylene bromide.

Ethylene Bromide. Dibrom-ethane. Different from ethyl bromide.

Eucalypteol. Eucalyptene bichloride (according to Lafarge). (Antiseptic.)

Eucalyptoresorcin. Combination of eucalyptol and resorcin.

Eulyptol. A mixture of salicylic acid, carbolic acid, and oil of eucalyptus. (Antiseptic.)

Euphorin. Phenyl-urethane. Phenylethylic urethane. Ethyl and phenyl carbamate.

Europhen. Diisobutylorthocresoliodide. Substitute for iodoform.

Exalgin. Methylacetanilid. Methylphenylacetamide. (Anodyne.)

Exodine. Mixture of acetanilid, sodium salicylate, and sodium bicarbonate. Exodyne. (Antipyretic.)

Expectorant, Stokes's. Senega and squill cough mixture with ammonium carbonate.

Extract of Apple, Ferrated. Crude iron malate.

Extractum Catholicum. Compound extract of rhubarb.

Martis Pomatum. Crude iron malate in the form of extract.

Panchymagogum Crollii. Compound extract of rhubarb. (Rhubarb, aloes, jalap, soap.)

Eyesolene. Eye-salve of Spitler & Drexler, Paterson, N.J.

Eyestones. Crabs' eyes.

F.

Faba Porcina. }
Suilla. } The fruit of Hyoscyamus niger.

Purgatrix. Castor oil bean.

Fæcula. Starch. (Amylum.)

Fairoline. Ointment of unknown composition.

Farina Hordei Præparata. Barley flour heated in a steam bath for about thirty hours.

Ferri Iodidum Saccharatum. Contains 20 per cent. pure ferrous iodide. U. S. P. 1890.

Ferri Scobs. Iron filings.

Ferro Pagliari. Solution of ferrous chloride.

Ferrugo. Iron rust.

Ferrum Alcoholisatum. Finely powdered iron, which is not the same as reduced iron.

Limatum. Iron filings.

Pomatum (extract, tincture, etc.). Iron malate.

Firwein. Contains bromine, iodine, and phosphorus with balsams. (Tilden & Co., New Lebanon, N.Y.)

Flake White. Carbonate of lead.

Flea Seeds. Seeds of Nigella.

Flores Antimonii. Antimony sesquioxide.

Benzoes. Benzoic acid.

Bismuthi. Bismuth oxide.

Zinci. Zinc oxide.

Flos Æruginis. Copper acetate.

Flos Salis. Sodium subcarbonate.

Fluor Spar. Calcium fluoride.

Flowers of Antimony. Oxide of antimony.

of Benjamin. Benzoic acid.

of Zinc. Oxide of zinc.

Fo-di-ta. A pepsin tablet. (New York & Chicago Chemical Co.)

Formalin. 40 per cent. solution. Formaldehyde. (Antiseptic.)

Formol. Formaldehyde.

Formylum Chloratum. Chloroform.

Fossiline. Similar to petrolatum, vaselin, etc. Vaselin.

Frankincense. Olibanum.

French Polish. An alcoholic solution of shellac.

White. Pulverized talc.

Friar's Balsam. Compound tincture of benzoin.

Fromentin. The embryo of wheat.

Fuligokali. An alkaline solution of soot evaporated to dryness.

Fuller's Earth. A species of clay.

Furfur. Bran.

Fustic, Old. The wood of Morus tinctoria.

Young. The wood of Rhus cotinus.

G.

Galactic. Lactic.

Galena. Lead sulphide.

Gallacetophenone. Methylketotrioxybenzol. Methylketotrioxybenzene. Trioxyacetophenone. Alizarin-yellow "C."

Gallein. Coal-tar color. Used as an indicator.

Gallobromol. Dibromogallic acid.

Gambir. Pale gum catechu.

Gannal's Solution. Solution of aluminum acetate.

Gelatol. Ointment basis, consisting of oil, glycerin, gelatin, and water.

Gentian, White. A German rural domestic medicine, which is dried white dog-dung.

Glacialin. Mixture of borax, boric acid, and sugar (or glycerin).

Glacies. Ice.

Mariæ. Isinglass-stone; Muscovy glass. (A variety of calcium sulphate.)

Glandes Quercus (Tostæ). Acorns. (Acorn coffee.)

Glass Gall. The scum forming on the surface of melting glass.

of Antimony. Vitrified antimony oxide.

Globuli Martiales. A crude iron tartrate in the form of balls or marbles.

Glonoin. Nitroglycerin. Trinitrin.

Glusidum. The official name for saccharin in the Brit. Ph.

Gluten. Glue.

Glycéré (Glycérat) (French). Soft or solid glycerin preparations.

Glycerinum Pepticum. One of Fairchild's pepsin preparations.

Glycerolé (French). Liquid glycerin preparations.

Glyceryl Borate. Boroglyceride.

Glyconin. A mixture of yolk of egg and glycerin.

Glycozone. Probably a solution of hydrogen peroxide in glycerin. (Marchand, New York.)

Gommeline. Crude dextrin.

Grains d'Avignon. French berries (Rhamnus infectorius).

Graphite. Black lead.

Green Vitriol. Ferrous sulphate.

Guaiacolsalol. Guaiacol salicylate. (Intestinal antiseptic.)

Gum Dragon. Tragacanth.

Gummi Elasticum. India rubber.

Guttæ (Gutti). Gamboge.

Rubrum Gambiense. Kino.

Scorpionis.
Thebaicum. } Gum arabic.

Gunjah. Cannabis Indica.

Gypsum. Plaster of Paris.

H.

Hæmatites. Bloodstone.

Hæmatogen. Iron albuminate, as found in eggs.

Hæmogallol. Produced by the action of pyrogallol upon the coloring matter of blood. Reduction product of hæmatin. Blood-producer.

Hæmol. Produced by the action of zinc-dust upon the coloring matter of the blood. Blood-producer.

Hamburg Drops. A kind of "Swedish Bitters."

Tea. Identical with St. Germain tea, differently flavored.

Hazeline. Trade-mark for a hamamelis preparation, Burroughs, Wellcome & Co.

Hazeline Snow. Trade-mark for a toilet preparation, Burroughs, Wellcome & Co., London.

Hemisine. Trade-mark for an active principle of suprarenal gland by Burroughs, Wellcome & Co., London.

Hepar. Liver (of sulphur, antimony, lime, etc.).

Antimonii. An impure antimonium and potassium sulphide.

Sulphuris. Potassa sulphurata. "Liver of sulphur."

Herba Corta. Specialty of Griswold, Hartford, Conn.

Hiera Picra. (Incorrectly, but commonly, called Hicra Picra.) Pulvis aloes et canellæ.

Hill's Balsam of Honey. A tincture of tolu, honey, etc.

Hips. The fruit of dog-rose.

Homberg's Phosphorus. Calcium chloride.

Pyrophorus. A mixture of alum and brown sugar, or of potassium sulphide, alumina, and charcoal.

Huxham's Tincture of Bark. Compound tincture of cinchona.

Hydracetine. Acetophenylhydrazine. Pyrodine. Acetylphenylhydrazine.

Hydrargyri Oxymurias. Corrosive chloride of mercury.

Hydrargyrus Muriatus. Corrosive chloride of mercury.

Hydrastis, Colorless. Solution of hydrastine in glycerin and water. (Keith & Co.)

Hydrochrite. Barley water.

Hydrolat (French). A distilled water.

Hydrolé (French). An aqueous solution.

Hydroleine. A kind of pancreatic emulsion of cod-liver oil. (Crittenden, New York.)

Hydronaphtol. Antiseptic. Said to be different from betanaphtol. (Rigney & Wolff, New York.)

Hydropege. Spring or hydrant water.

Hydrophilous (Hygrophilous) Cotton. Absorbent cotton.

Hygrine. One of the alkaloids of coca.

Hypnal. Chloral-antipyrin. Trichloraldehydphenyldimethylpyrazolone. (Hypnotic.)

Hypnone. Acetophenone. (Hypnotic.)

Hypoderms. Tablets for hypodermic injections. (Allen & Hanbury, London.)

I.

Ichthyocolla. Isinglass.

Ichthyol. Ammonium ichthyol-sulphonate from a peculiar bituminous shale.

Indian Pink. Spigelia marilandica.

Tobacco. Lobelia inflata.

Indicum. Indigo.

Inflammable Air. Hydrogen.

Ingluvin. Pepsin obtained from the crop of chicken.

Injection Brou. A French specialty for gonorrhœa.

Iodol. Pyrrol tetraiodide. Tetraiodopyrrole. (Antiseptic, alterative.)

Iodophenine. Combination of phenacetin with iodine. (Antiseptic.)

Iodophenochloral. Mixture of tincture of iodine, carbolic acid, and chloral hydrate.

Iodopyrine. Iodoantipyrine. Antipyrine monoiodide.

Iron, Alcoholized. Finely powdered iron. It is not the same as iron by hydrogen.

by Hydrogen. Reduced iron.

Nitrogenized. Syrup of iron and sodium albuminates.

Issue Peas. Small orange berries, or round pills turned from orris root.

Izal. By-product obtained in coke-formation. "Thorncliffe disinfectant."

J.

Japan Earth. Catechu.

Jap-Menthol. Menthol from Japanese oil of peppermint.

Jesuits' Bark. Cinchona.

Drops. Contain guaiacum, sarsaparilla, and Peruvian balsam.

Jews' Pitch. Asphaltum.

Judas's Ear. A fungus of elder-tree. (Exidia.)

Jupiter. An ancient name for tin.

Jusculum. Broth (of beef, veal, turtle, etc.).

K.

K. See also C.

Kairine. Oxychinolinethyl hydrochlorate. (Antipyretic.)

"A." Oxyquinolinethylhydride. (Antipyretic.)

Kali Aeratum. Potassium carbonate.

Kalicum Hydras. Fused potassa.

Kalium, Kali. Potassium, potassa.

Kaolin. China clay. A hydrated silicate of alumina.

Kefir. A kind of kumyss.

Kelene. Chelen. Ethyl chloride.

Kepler. Trade-mark applied to malt and other preparations, Burroughs, Wellcome & Co., London.

King's Yellow. Yellow arsenic sulphide.

Kochine. Tuberculin.

Kodozonol. Ozonized cod-liver oil. (Ozone Co., New York.)

Kreozonol. Ozonized oil of tar. (Ozone Co., New York.)

Kresin. A solution of cresol in a solution of sodium cresoxyl-acetate. (A 25-per-cent. solution.)

Kresylol. See Cresylol.

Kumysgen. Kumyss in a dry form. (Reed & Carnrick, New York.)

L.

Lac Magnesiæ. Milk of magnesia.

Virginis. See Virgin's Milk.

Lacca Cœrulea. Litmus.

Musica (Lakmus). Litmus.

Lactin. Sugar of milk.

Lacto Preparata. A kind of malted milk with cereals, etc. (Reed & Carnrick, New York.)

Lakmoid. Substitute for litmus; a coal-tar color.

Lamium Album. Blind nettle.

Lamotte's Drops. Ethereal tincture of ferric chloride.

Lanadeps. A purified lanolin. (Lloyd & Co., Leicester, England.)

Lanain. Adeps lanæ. Lanolin.

Lana Philosophica. Zinc oxide.

Lanesin. Similar to lanolin.

Lanolin. Purified wool fat emulsified with water. Adeps lanæ. Lanain.

Lapides Cancrorum. Eyestones.

Lapilli Cancrorum. Crab's eyes, crab-stones; concretions found in the stomach of the European crawfish.

Lapis Baptista. Ancient name for talcum.

Calaminaris. Impure zinc carbonate.

Causticus. Potassa. (In sticks.)

Cœruleus. Copper sulphate.

Divinus. Copper aluminate.

Hæmatites. Bloodstone.

Infernalis. Lunar caustic. (Fused silver nitrate.)

Lazuli. Ultramarine.

Ophthalmicus. Eyestones.

Smiridis. Emery.

Latrol. A substitute for iodoform. By the action of iodine upon one of the anilines. (Clinton Pharm. Co.)

Ledoyen's Disinfecting Liquid. Solution of nitrate of lead.

Lenitive Electuary. Confection of senna.

Leucœnus. White wine.

Leucogene. Sodium bisulphite.

Levant Nut. Cocculus Indicus. (Fish berries.)

Lichen Islandicus. Iceland moss.

Life-Everlasting. Gnaphalium polycephalum.

Lignia Nitrica. Gun-cotton.

Lignum Sanctum. Guaiacum wood (Lignum vitæ.)

Vitæ. Guaiacum wood.

Limatura Ferri. Iron filings.

Linonine. Compound emulsion of linseed oil. (Danbury Pharm. Ass., Conn.)

Lintine. Absorbent cotton in thin sheets. (Johnson & Johnson, New York.

Lipanin. An olive oil containing 6 per cent. of free oleic acid. (Alterative.)

Liquor Anodynus (Hoffmanni). Hoffmann's anodyne.

Cornu Cervi (Liquor C.C.). Solution of ammonium carbonate, containing empyreumatic oil.

Cornu Cervi Succinatus (Liquor C. C. Succinatus). Solution of ammonium succinate.

Ferri Oxychlorati. Dialyzed iron.

Fumans Boylii. Ammonium hydrosulphide.

Salicylicus, Sellers's. Contains sodium and quinine salicylates and salicin.

Seriparus. Liquid rennet.

Stypticus Loofii. Solution of ferric chloride.

Tongæ Salicylatus. See Tongaline.

Listerine. Antiseptic. Contains borax, thymol, eucalyptol, oils of wintergreen, peppermint, etc.

Lithiated Hydrangea. Kidney remedy. Contains hydrangea and lithium benzosalicylate. (Lambert Co., St. Louis.)

Lithines. Lithia water tablets. (Metcalf & Co., Boston.)

London Paste. Soda with lime.

Looch Album. An emulsion of almonds and oil of almonds.

Loofah. "Vegetable sponge;" the skeleton of a gourd.

Losophan. Triiodometacresol. Triiodometacresylic acid. (Antiseptic dermic.)

Love-Apple. Tomato.

Luna. Silver.

Lysol. Mixture of cresols with soap. (Antiseptic.)

M.

Magisterium Bismuthi. Bismuth subnitrate.

Coccionellæ. Carmine.

Sulphuris. Washed sulphur.

Magnesia Alba. Magnesium carbonate.

Nigra. Black manganese oxide.

Mala. Poma (apple).

Mallein. A product of the "epizootic" bacilli, prepared by Adamkiewicz. Alexine of glanders, according to Adamkiewicz.

Marcasita. Metallic bismuth.

Marine Acid. Hydrochloric acid.

Salt. Sodium chloride.

Mars, or Martis. Iron (Tinctura Martis is tincture of iron).

Massicot. Lead protoxide.

Mater Metallorum. Mercury.

Matta. The cortical portion from a variety of millet-seed, used for adulterating pepper.

Maw-Seed. Poppy-seed.

Meadow Saffron. Colchicum.

Meconium. The juice of the poppy.

Medulla Bovis. Ox-marrow.

Lactis. Butter.

Sassafras. Sassafras pith.

Mel Ægyptiacum. Liniment of copper.

Melanosmegma. Soft (green) soap.

Meleguette Pepper. Grains of Paradise.

Mellite (French). A honey.

Mephite of Soda. Impure sodium carbonate.

Mercure Précipité Blanc (French). White precipitate.

Mercurius Dulcis. Calomel.

Præcipitatus Albus. A name for calomel.

Mortis.
Vitæ. } Antimony oxide.

Mercury Alanin. Mercury amidopropionate.

Hahnemann's Soluble. Black mercury oxide.

Methacetine. Paraacetanisidine. Paraoxymethylacetanilid. Acetylmethylparamidophenol. (Antipyretic.)

Methanilid. Exalgin.

Metheglin. Honey wine. Mead.

Methonal. Dimethylsulphonedimethylmethane.

Methozin. Antipyrin.

Methylal. Methylenedimethylic ether. (Anæsthetic.)

Metol. Salt of monomethylparaamidometacresol (for photographic uses).

Metopium. Expressed oil of almonds.

Metozin. Antipyrin.

Metrenchyta. Vaginal injection; sometimes a vaginal syringe.

Mica Panis. Bread crumb.

Microcidin. Sodium betanaphtol. Sodium betanaphtolate (75 per cent.). (Antiseptic.)

Microcosmic Salt. A mixture of sodium and ammonium phosphates.

Mikozone. Hypnotic and sedative. (A variety of chlorodyne).

Milk of Sulphur. Precipitated sulphur. (Strictly only that precipitated by sulphuric acid.)

Virgin's. Rose-water rendered milky by the addition of tincture of benzoin.

Mineral Gum. Soluble glass; sodium or potassium silicate.

Minium. Red lead.

Græcorum, Minium Purum. Red mercuric sulphide.

Miraculum Chemicum. Magnesium carbonate.

Mithridate. See Confectio Damocratis.

Mistura Acaciæ. Mucilage of gum arabic of variable strength.

Oleoso-Balsamica. An alcoholic solution of Peru balsam, oil of amber, and sundry volatile oils.

Mixtura Alba. Compound chalk mixture.

Salina. Potio Riveri. (Effervescent mixture of potassium citrate.)

Solvens. Solution of ammonium chloride with liquorice.

Solvens Stibiata. Solution of ammonium chloride with liquorice and tartar emetic.

Mixture, Antidysenteric. Acid camphor mixture.

Dysmenorrhœa. Guaiac mixture with corrosive sublimate.

French. Carbolized solution of iodine.

Gadberry's. Acid mixture of quinine and iron.

Griffith's. Compound mixture of iron.

Hope's. Acid camphor mixture.

Mollin. Ointment basis, consisting of a glycerin soap containing an excess of fat or oil.

Mollisin. Ointment basis of 4 parts of paraffin oil and 1 part of yellow wax.

Molybdos. Lead.

Morrhuol. Alcoholic extract of cod-liver oil.

Mosaic Gold. Tin bisulphide.

Mosquera Preparations. Contain meat digested by pine-apple juice. (Parke, Davis & Co., Detroit, Mich.)

Mountain Fat. Paraffin.

Muride.
Murina. } Bromine.

Muscus. Moss. (Iceland, Irish, etc.)

Myrrholin. Solution of myrrh in castor oil, equal parts. (Alterative.)

N.

Naphæ Flores (Aqua). Orange flowers (water, etc.).

Naphtha. Prescribed by English physicians, means pyroxylic and pyroacetic spirits. In German prescriptions it means ether; often written naphtha vitrioli.

Vitrioli. Ether.

Naphthalol. Betol.

Naphthopyrin. Combination of betanaphtol with antipyrin.

Naphthosalol. Betol.

Naphthyl. Naphtol.

Natrium, Natron. Sodium, soda.
Natro-Kali Tartaricum. Rochelle salt.
Neapolitan Ointment. Mercurial ointment.
Neogale. Fresh milk.
Nepenthe. A preparation of opium. (Ferris & Co., Bristol, England.)
Nico. Nickel carbonmonoxide.
Nigramentum. Black ink.
Nihil Album. Crude zinc oxide.
  Griseum. Zinc oxide.
Nikalgin. An anesthetic and antiseptic for wounds.
Nitratine. Sodium nitrate.
Nitre, Rough. Magnesium chloride.
Nitrobenzin. **Nitrobenzol.** Artificial oil of bitter almonds.
Nitrum Flammans. Ammonium nitrate.
  Saturninum. Lead nitrate.
Nix Zinci. Zinc oxide.
Norwood's Tincture. A tincture of Veratrum viride, U. S. P. 1890 strength.
Number Six. Tincture of capsicum and myrrh. (Hot drops.)
Nux Aromatica. Nutmeg.
  Metella. Nux vomica.
  Moschata. Nutmeg.

O.

Œnanthic Ether. Artificial oil of cognac.
Œsipus. Suint. Impure wool fat.
Oil, "American." Scandinavian for castor oil.
  of Bay. Oil of laurel berries. (Generally is understood to mean oil of bay rum.)
  of Ben (**or Behen**). Comes from a Moringa, and is not the same as oil of benne, which comes from a Sesamum.
  of Cassia, Artificial. Cinnamic aldehyde is sometimes sold under this title.
  Colza. Oil of rapeseed.
  Dagget. Empyreumatic oil of birch. (Oil of Russia leather.)
  Dippel's. Rectified oil of hartshorn.
  of Eggs. By expression from hard-boiled yolks.
  Leaurelle. A preparation for the complexion. (Proprietary.)
  Lucca. A brand of good olive oil.
  of Niobe. Methyl benzoate.
  St. Jacob's. A liniment. (Specialty of Vogeler, Baltimore.)
  Seneka. Crude petroleum.
  of Smoke. Creosote.
  Swallow. Infused oil of elder flowers.
  of Tartar. Solution of potassium carbonate.
  of Vitriol. Sulphuric acid.
Ointment, Black Basilicon. Basilicon ointment with pitch.
  Maury's. A compound rhubarb ointment.
  Volatile. Volatile liniment.
Oleite. Sodium sulphoricinoleate.
Oleosa. A special brand of eucalyptus oil. (Drysdale & Co., London.)
Oleum Animale Fœtidum. Crude oil of hartshorn.
  Anthos. Oil of rosemary.
  Betulinum. Empyreumatic oil of birch. (Oil of Russia leather.)
  Bubulum. Neatsfoot oil.
  Cadinum. Empyreumatic oil of juniper.
  Camphoratum. Liniment of camphor.
  Castoris. Castor oil. (Has nothing to do with castoreum.)
  Cedræ (**de Cedro**). Oil of lemon.
  Chaberti. Rectified animal oil.
  Chamomillæ Citratum. Oil of lemon, distilled over German chamomile.
  Cocois. Oil of cocoanut.
  Coctum. Fixed oil (olive oil) infused with the respective herb, etc.
  Cornu Cervi (**Fœtidum**). Crude animal oil.
  Fermentationis. Fusel oil.
  Juniperi Oxycedri (**Empyreumaticum**). Oil of cade.
  Laurinum. Expressed oil of laurel berries.
  Lumbricorum. Infused oil of earthworms.
  Napi. Rapeseed oil.
  Nucis Moschatæ. Besides the two kinds of oils (volatile and fixed) see also Balsam Nucistæ.
  Nucistæ. Expressed or volatile oils of numeg.
  Palmæ Christi. Castor oil.
  Petræ. Crude petroleum. (Seneka oil.)
  Philosophorum. Olive oil distilled over hot bricks.
  Portugallicum. Oil of bergamot.
  Rusci. Empyreumatic oil of birch. (Oil of Russia leather.)
  Tartari per Deliquium. Concentrated solution of potassium carbonate.
  Templinum. Oil of pine cones and small branches of Pinus pumilio.
Onguent (French). Ointment which contains resin.
Opodeldoc, Steers's. Solid opodeldoc.
Orellana. Arnotta.
Orexin. Phenyldihydrochinazoline hydrochloride. Phenyldihydroquinazoline. (Appetizer)
Orleana. Annotta.

Orthine. Orthohydrazineparaoxybenzoic acid. (Antiseptic, antipyretic.)

Oryza. Rice.

Os Sepiæ. Cuttlefish bone.

Oxalium. Potassium binoxalate.

Oxychinaseptol. Orthophenolsulphonate of oxychinoline.

Oxy-di-methyl-chinizin. Antipyrin.

Oxygen Powder. Sodium peroxide containing 20 per cent. active oxygen. (Bleacher.)

Oxymel. Honey boiled with vinegar.

  Æruginis. Honey with copper acetate.

Oxymellite (French). Honey with vinegar.

Ozokerite. Earth-wax; an impure paraffin.

P.

Palacetyrus. Old cheese.

Palatinoid. Gelatin capsule with dry powder.

Panacea Mercurialis. Calomel.

Panchymagogum Minerale (P. Quercitani). Calomel.

Pancro-Bilin. Ox-gall and pancreatin (Reed & Carnrick, New York.)

Pan-Peptic Preparations. Specialty of Sharp & Dohme, Baltimore.

Papine. A preparation of opium. (Battle & Co., St. Louis.)

Papoid. Digestive principle of the fruit of Carica papaia.

Paraffinum Molle. Petrolatum.

Paroleine. Trade-mark for a preparation of tasteless petroleum oil, Burroughs, Wellcome & Co., London.

Passulæ. Raisins.

  Minores. Corinthian raisins. (Grocers' "currants.")

Pasta Cerata. Ointment basis, consisting of yellow wax, water, and potassium carbonate.

Peacock's Bromides. Contains potassium, sodium, calcium, ammonium, and lithium bromides. (St. Louis.)

Pearl White. Bismuth subnitrate.

Pelletierine. Alkaloid of pomegranate bark.

Pental. Trimethylethylene. Betaisoamylene. (Anæsthetic.)

Pepperette. Olive pits. (For adulterating pepper.)

Pepsalia. A peptic salt (probably pepsin and salt) for table use. (Stern, London.)

Perloids. A style of capsules. (Proprietary.)

Persio. Cudbear.

Phenacetine. Paraacetophenetidine. Phenin. Oxyethylacetanilid. (Antipyretic, anodyne.)

Phenates. Carbolates.

Phenazone. Antipyrin.

Phenetidin. Phenacetin.

Phenetol. Ethyl phenate.

Phenic Acid. Carbolic acid.

Phenin. Paraacetophenetidine. Phenacetin.

Phenocoll. Amidoacetoparaphenetidine. Glycocoll-paraphenetidine. (Antipyretic.)

Phenofax. Trade-mark applied to an antiseptic surgical dressing, Burroughs, Wellcome & Co., London.

Phenolin. Mixture of soap with cresols.

Phenolphthalein. A coal-tar color. Indicator in analysis.

Phenolsulphonate. Sulphocarbolate.

Phenopyrin. Combination of carbolic acid with antipyrin.

Phenosalyl. Mixture of carbolic acid, salicylic acid, lactic acid, menthol, and eucalyptus oil. (Antiseptic.)

Phenyl. Phenol.

Phenylacetamide. Acetanilid, *U. S. P.*

Phenyl-di-methyl-iso-pyrazolon. Antipyrin.

Phenyl-di-methyl-pyrazolon. Antipyrin.

Phenylic Acid. Carbolic acid.

Phenylone. Antipyrin.

Phosphin. A coal-tar color. Chrysanilin nitrate.

Photoxylin. Similar to gun-cotton, but made from wood-pulp.

Phyllis Amara. Bitter almond bran.

Physostigmine. Eserine.

Phytoline. Antifat. From poke berries by a peculiar process. (Walker Pharm. Co., St. Louis.)

Pichi. Fabiana imbricata.

Picrol. Diiodoresorcinmonosulphonic acid.

Picropyrin. Combination of picric acid with antipyrin.

Pills, Eternal. Pills of metallic antimony, about 15 grains each, which, after use, were recovered from the stools and washed.

  Lapactic. Sharp & Dohme's specialty. (Baltimore.)

  Perpetual. See Pills, Eternal.

Pinguedo. Lard.

Pinguoleum. Fixed oil.

Pink Powders. Contain calomel and sugar, colored with a little carmine.

  Saucer. The coloring matter is derived from safflower.

Pinus Canadensis, Kennedy's. Dark: compound fluid extract of Pinus canadensis. White: compound solution of zinc sulphate.

Piperazidin. Piperazin.

Piperazin. Diethylendiamine. Ethylenimine. (Uric acid solvent.)

Pip-Menthol. Menthol from American and European oil of peppermint.

Pisselæum Indicum. Petroleum.

Plasma. Glycerite of starch.

Plasment. Basis for urethral injections. A slimy solution of Irish and Iceland moss with admixture of glycerin and benzoin.

Plaster, Diachylon. Lead plaster.

Nuremberg. Brown plaster. Mother plaster.

Platt's Chlorides. Contains aluminum, sodium, zinc, and calcium chlorides.

Plumbago. Black lead. Also a genus of herbs.

Plumbum Album. Tin.

Scytodepsicum. Moist lead tannate.

Plutonium. Barium.

Poivrette. Olive pits; adulterant of pepper.

Polysolve. Alkaline salts of sulpholeic acid.

Poma Aurantii (-iorum). Orange buds.

Pommade (French). Ointment which does not contain resin.

Pompholix. Zinc oxide.

Pond's Extract. A private make of "distilled extract of witch-hazel" (hamamelis).

Potash for Gargling. Potassium chlorate.

Potassium Chromate (neutral). Yellow potassium chromate.

Hydriodate. Potassium iodide. (Kalium hydro-iodicum of German prescriptions.)

Rhodanate. Potassium sulphocyanide (-cyanate).

Pot-Pourri. Fumigating species, chiefly flowers, generally preserved with salt.

Powder, Digestive. Compound powder of pepsin.

of Algaroth. Antimony oxide.

Précipité Blanc (French). This, in French prescriptions, for internal use, is calomel (by the wet process), and for external use it generally means white precipitate.

Primuline. Sodium thioparatoluidine-sulphonate.

Prussian Blue. Iron ferrocyanide.

Pulvis Ærophorus. Effervescing powder. (Soda, Seidlitz.)

Diatragacanthæ. Starch, liquorice root, gum arabic, and sugar.

Digestivus. Rhubarb, saltpetre, and cream of tartar.

Gummosus. See Pulvis Diatragacanthæ.

Infantum. When for internal use: magnesia and rhubarb, with oil of fennel. When for external use: baby dusting-powder.

Jacobi. Antimonial powder.

Puerorum. See Pulvis Infantum (internal use).

Pumiline. A distillate from Pinus pumilio, in a variety of forms. (Stern, London.)

Punicine. Pelletierine; alkaloid of pomegranate bark.

Purple of Cassius. Gold precipitated from solution by tin chloride.

Putty Powder. Polishing substance. Tin oxide.

Putz Pomade. A polishing ointment, containing ferric oxide, and probably pumice-stone.

Pyoktanin, Blue. Methylviolet.

Yellow. Auramine.

Pyracine. Antipyrin.

Pyrazolone. Antipyrin.

Pyretin. A new antipyretic of, as yet, unknown composition.

Pyrodine. Acetophenylhydrazine. Hydracetin. Acetylphenylhydrazine.

Pyrœnus. Alcohol.

Pyrogallopyrin. Combination of pyrogallol with antipyrin.

Pyrolignine. A "ligneous" (*sic*) product from wood tar. (Borst, Montreal, Canada). (Antipyretic.)

Pyrophorus. A mixture of certain substances which ignite spontaneously when exposed to the air.

Pyroxylin. Gun-cotton.

Pyrozole. One of the coal-tar chemicals. (Pyrozole Chem. Co., St. Louis.) (Antipyretic.)

Pyrozone. Hydrogen peroxide rendered permanent in ether. (Specialty, McKesson & Robbins, New York.)

Q.

Quaker Button. Nux vomica.

Quaker's Black Drop. Vinegar of opium.

Quassation. In pharmacy, the act of reducing roots and tough barks to morsels.

Quévenne's Iron. Iron reduced by hydrogen.

Quickine. A solution of 1 part of carbolic acid and 0.02 part of mercuric chloride in 100 parts of dilute alcohol.

Quickwater. Solution of mercuric nitrate.

Quinine, Amorphous. The ether soluble part of quinoidine.

Quinole. Hydroquinone (for photographic purposes).

R.

Radical Vinegar. Glacial acetic acid.

Raisins, Corinthian. Grocers' currants.

Ramenti Ferri. Iron filings.

Realgar. Red arsenic sulphide.

Reddle. Red chalk.

Regulus (Antimonii, etc.). The pure metals, when separated by fusion.

Resina Elastica. India rubber.

Empyreumatica Liquida. Tar.

Empyreumatica Solida. Pitch.

Flava. Rosin. (Colophony.)

Pini. Turpentine (solid, hard).

Resopyrin. Compound of resorcin and antipyrin.

Resorcinol, Resorcin. This name has also been given to the fused product of resorcin and iodoform. (Bielaiew.)

Resorcinopyrin. Combination of resorcin and antipyrin.

Retinol. Rosin oil. Rosinol. Resinol. (Antiseptic, astringent.)

"Rex." Extract of beef of Cudahy, Omaha, Neb.

Metallorum. Gold.

"Rham. Cat." Abbreviation of Rhamnus catharticus. (Buckthorn berries.)

Rixoline. Artificial oil of turpentine.

Rizine. Rice, partially acted upon by superheated steam.

Rob (Roob). Inspissated juice (of elderberries, carrot, juniper berries, etc.).

Rodinal. Paraamidophenol. (For photographic purposes.) Solution of paraamidophenol hydrochlorate, sodium sulphite, and potassa in water.

Rose Pink. Whiting colored with decoction of Brazil wood and pearl ash.

Rosinol. Rosin oil.

Rotterin. Antiseptic solution, containing zinc chloride and sulphocarbolate, salicylic acid, boric acid, citric acid, thymol, and sodium chloride. Also in pastilles.

Rotulæ. Lozenges.

Rouge. Red ferric oxide.

Card. Sodium carthamate, from safflower.

Rubigo Ferri. Iron-rust.

Rubramentum. Red ink.

Ruddle. A kind of red chalk.

Rufus's Pills. Pills of aloes and myrrh.

Rusot. Extract of Berberis lycium.

S

Sacchari Fœx. Molasses.

Saccharolé (French). Any moist liquid preparation (except syrup) which contains sugar in large proportions.

Saccharum Acernum. }
Canadense. } Maple sugar.

Candum (Candisatum). Rock candy.

Saturni. Sugar of lead.

Saccharure (French). Dry saccharolé; medicated sugars.

Saffranin. A coal-tar color.

Saffron, American. Safflower.

Safrol. A synthetic oil of sassafras; now mostly obtained from oil of camphor, $C_{10}H_{10}O_2$. Specific gravity 1.098 to 1.100. U. S. P. VIII.

Saim. Adeps.

Sal Absinthii. Potassium carbonate.

Acetosellæ. Potassium oxalate. (Generally oxalic acid is expected.)

Æratus. Potassium carbonate.

Alembroth. A mixture of mercuric and ammonium chlorides.

Amarum. Magnesium sulphate.

Ammoniacum Martiale. Iron ammonio-chloride.

Ammoniacum Secretum Glauberi. Ferrous sulphate.

Ammoniacum Volatile. Ammonium carbonate.

Anglicum. Magnesium sulphate.

Argenti. Silver nitrate.

Armeniacum. Ammonium chloride.

Artis. A mixture of mercuric and ammonium chlorides.

Benjamin. }
Benzoin. } Benzoic acid.

Catharticus Amarus. Magnesium sulphate.

Catharticus Anglicanus. Magnesium sulphate.

Catharticus Glauberi. Sodium sulphate.

Chalybis. Iron sulphate.

Cornu Cervi. Ammonium subcarbonate.

de Duobus. Potassium sulphate.

Diureticus. Potassium acetate.

Enixum. Potassium bisulphate.

Essentiale Tartari. Tartaric acid.

Fossilis. Sodium chloride.

Fuliginis. Ammonium carbonate.

Gemmæ. Sodium chloride.

Lactis. Milk sugar.

Marinum. Sea salt.

Martis. Ferrous sulphate.

Microcosmicum. Salts of urine.

Mirabile Glauberi. Sodium sulphate.

Mirabile Perlatum. Sodium phosphate.

Nitrum. Potassium nitrate.

Ossium. Ammonium carbonate.

Panchrestum. Potassium tartrate.

Petræ. Potassium nitrate.

Polychrestum Seignetti. Sodium tartrate.

Polychrestus. Potassium sulphate.

Polychrestus Glaseri. Potassæ sulphas cum sulphure.

Prunelle. Potassium nitrate.

Rupellensis. Rochelle salt.

Sapientiæ. Sal alembroth.

Saturni. Lead acetate.

Scientiæ. Sal alembroth.

Sedativus Hombergi. Boracic acid.

Sal Sedlicensis. Magnesium sulphate.

Sennerti. Potassium acetate.

Seydschutzense. Magnesium sulphate.

Succini. Succinic acid.

Tartari. Potassium carbonate.

Tartari Essentiale. Tartaric acid.

Thermarum (Carolinarum). Carlsbad salt.

Urinæ. Sodium phosphate.

Vegetabile. Potassium tartrate.

Vitæ. Sal alembroth.

Vitrioli. Zinc sulphate.

Vitrioli Narcoticum. Boracic acid.

Volatile. Ammonium carbonate.

Volatile Liquid. Ammonia water.

Vomitorium Vitrioli. Zinc sulphate.

Salacetol. Salicylacetol. (Antirheumatic.)

Salamander's Blood. Fuming nitric acid.

Salbromalide. Antinervine.

Salicyl-Bromanilide. Antinervine.

Salinaphtol. Betol.

Saliphene. Salicylphenetidine.

Salipyrin. Antipyrin salicylate.

Salitonia. A saline tonic. (Phenique Chem. Co., St. Louis.)

Salmiac. Ammonium chloride.

Salol. Phenyl salicylate. Phenol salicylate. Phenylic ether of salicylic acid.

Salophene. Acetylparaamidosalol. (Antirheumatic.)

Salt, Fruit. A variety of Seidlitz (or Seltzer) aperient.

Herapath's. Quinine iodosulphate.

Microcosmic. Sodium and ammonium phosphate.

Seignette. Rochelle salt.

Sore-Throat. Sal prunellæ.

of Tartar. Pure potassium carbonate.

of Tin. Tin chloride.

Salve Pencil. Ointment in the shape of a pencil or stick.

Sandiver. See Glass Gall.

Sandyx. Red lead oxide.

Sanmetto. A combination of santal oil and saw-palmetto. For bladder-complaints. (Od. Chem. Co., New York.)

Santal Midy. Gonorrhœa capsules of Grimault & Co., in Paris.

Santoninoxim. Derivative of santonin.

Sapo Medicatus. A good quality of neutral white Castile soap.

Sapocarbol. Mixture of cresols with soap. (Antiseptic.)

Saponiment. A kind of compound soap liniment.

Saprol. Mixture of crude cresols with hydrocarbons. (Antiseptic.)

Sarco-Peptones. Specialty of Rudish. (Meat peptone.)

Saturatio. Solution of sodium citrate.

Saturnus (Saturni). Lead.

Schweinfurth's Green. Copper arsenite.

Sea-Onion. Squill.

Sebum (Sevum). Suet. Tallow.

Sedatine. Antipyrin. Also applied to paravalerylamidophenetol. (A new sedative.)

Sedox. A new dressing for wounds, etc., similar to cotton.

Seignette's Salt. Rochelle salt.

Semen Contra. Wormseed from Barbary.

Semen Cynæ. Santonica. Levant wormseed.

Sanitum. The seed of Artemisia santonica.

Semencina. Levant wormseed. (Santonica.)

Semina Strychni. Nux vomica.

Serosine. Bromo-anilid. (Antipyretic.) (Serosine Chem. Co., St. Louis.)

Serum (Lactis, etc.). Whey (milk, etc.).

Sideros. Iron.

Siliqua Dulcis. St. John's bread.

Soloid. Trade-mark for compressed and other chemicals for making lotions, etc. Burroughs, Wellcome & Co., London.

Sol. Gold.

Solution, Goadby's. A preserving solution for animal substances, containing salt, corrosive sublimate, and arsenic.

Solutol. A solution of sodium cresolate in excess of cresol. Solution of cresols in sodium cresylate. (Disinfectant.)

Solveol. A solution of cresolene in sodium salicylate. Solution of cresols in sodium cresotate. (Surgical antiseptic.)

Solvin. See Polysolve.

Somnal. Solution of chloral hydrate and urethane in alcohol.

Sozal. Aluminum salt of paraphenolsulphonic acid.

Sozoiodol (difficultly soluble). Potassium salt of diiodoparaphenolsulphonic acid.

Mercury, Zinc, etc. The respective salts of diiodoparaphenolsulphonic acid.

Sozoiodol (easily soluble). Sodium salt of diiodoparaphenolsulphonic acid.

Spanish White. Bismuth subnitrate.

Sparadrap. Spread adhesive plaster.

Spathum Fluoricum. Fluor-spar.

Species Pectorales. Pectoral species. ("Breast tea.") N. F. IV.

Spelter. Zinc.

Speltrum. Zinc.

Sperma Mercurii. Mercury acetate.

Spermine. An aqueous infusion obtained from the prostate gland and testicles of animals. (Nerve tonic.)

Spina Cervina (Baccæ, etc.). Buckthorn berries, etc.

- **Spirit of Nitre.** Crude nitric acid.
  - **Pyro-Acetic.** Acetone.
  - **of Salt.** Crude muriatic acid.
  - **of Turpentine.** Oil of turpentine.
- **Spiritus.** See also Liquor.
  - **Inflammabilis.** Alcohol (sometimes whiskey).
  - **Juniperi.** Generally gin.
  - **Lethalis.** Carbonic acid.
  - **Mindereri.** Solution of ammonium acetate.
  - **Muriatico-Æthereus.** Spirit of chloric ether. (Not that containing chloroform.)
  - **Muriatico-Æthereus Martiatus.** Tinctura ferri chloridi ætherea.
  - **Nitri Dulcis.** Sweet spirit of nitre.
  - **Nitri Duplex.**
Nitri Fumans.
Nitri Glauberi. } Nitric acid.
  - **Nitrico-Æthereus.** Sweet spirit of nitre.
  - **Odoratus.** Cologne.
  - **Pyroxylicus.** Methylic alcohol.
  - **Sacchari.** Rum.
  - **Salis Dulcis.** Spirit of chloric ether. (Not that containing chloroform.)
  - **Salis Fumans.** Muriatic acid.
  - **Sulphurico-Æthereus.** Spirit of ether. (Hoffmann's drops.)
  - **Veneris.** Acetic acid.
  - **Vitrioli.** Diluted sulphuric acid.
  - **Vitrioli Dulcis.** Hoffmann's anodyne.
- **Spodium.** Crude bone charcoal. (Ivory-black.)
- **Spritz.** A laboratory wash-bottle.
- **St. Germain Tea.** Contains senna, manna, elder-flowers, and fennel or anise.
- **Stannum Cinereum.**
Glaciale. } Bismuth.
  - **Indicum.** Zinc.
- **Steapsin.** Emulsifying ferment of the pancreatic juice.
- **Stearin.** Stearic acid.
- **Steel Mixture.** Mistura ferri composita.
- **Stibio-Kali Tartaricum.** Tartar emetic.
- **Stibium.** Antimony.
- **Stilus (Stylus).** Ointment in the shape of pencil or stick.
- **Stipites Dulcamaræ.** Dulcamara.
- **Storax Calamita.** Solid storax. (Generally sawdust or residue of cinchona preparations mixed with liquid storax.)
- **Stoughton's Elixir.** Compound tincture of gentian.
- **Stypteria.** Alum.
- **Styracol.** Guaiacol cinnamate. Cinnamylguaiacol. (Antiseptic.)
- **Styrone.** Cinnamyl alcohol.
- **Succata.** "Citron" of the grocers.
- **Succinum (Oleum, etc.).** Amber (Oil, etc.)
- **Succolata.** Chocolate.
- **Sucrate** (French). A saccharate.
- **Sucrol.** Paraphenetolcarbamide. (Sweetener.)
- **Suffitus.** Fumigation.
- **Sugar Sand.** Crude milk sugar.
- **Suint.** Œsipus. Impure wool fat. (Antiseptic.)
- **Sulphaminol.** Thio-oxydiphenylamine.
- **Sulphas Americanus Australis.** Quinine sulphate.
- **Sulphonal.** Diethylsulphonedimethylmethane. (Hypnotic.)
- **Sulphur Antimoniatum Fuscum.** Precipitated sulphuret of antimony.
  - **Auratum.** Golden sulphur. (Antimony sulphide.)
  - **Nigrum.** Impure native sulphur.
  - **Stibiatum Rubrum (Rubeum).** Kermes mineral, antimony, sulphide and oxide.
  - **Vivum.** Impure native sulphur.
- **Sydenham's Laudanum.** Wine of opium.
- **Syrup, Cuisinier.** Compound syrup of sarsaparilla.
  - **of Figs.** A kind of compound syrup of senna. (California Fig Syrup Co., San Francisco.)
- **Syrupus Communis.** Molasses.
  - **Diacodii.** Syrup of poppy-heads.
  - **Domesticus.** Syrup of buckthorn berries. (Generally molasses.)
  - **Empyreumaticus.** Molasses.
  - **Fuscus.** Molasses.
  - **Hollandicus.** Molasses.

T.

- **Tabloids.** Trade-mark applied to compressed and other goods, etc. Burroughs, Welcome & Co., London.
- **Taffetas.** Plaster spread on silk.
- **Tartarus.** Crude potassium bitartrate (argols). Then, several potassium salts.
  - **Boraxatus.** Potassium and sodium borotartrate.
  - **Natronatus.** Rochelle salt.
  - **Tartarisatus.** Potassium tartrate.
  - **Vitriolatus.** Potassium sulphate.
- **Terebinthina Cocta.** Turpentine (hard, solid).
- **Terra Cariosa.** Rotten-stone.
  - **Foliata.** Sulphur.
  - **Foliata Mineralis.** Impure sodium carbonate.
  - **Foliata Tartari.** Potassium acetate.
  - **Fullonica.**
Fullonum. } Fuller's earth.
  - **Japonica.** Catechu.
  - **Ponderosa.** Natural barium sulphate.
  - **Sigillata (Alba, Rubra).** White and red bole.

Terraline. A preparation from petroleum products, for internal use. (Terraline Co., Washington, D.C.)

Tetraiodpyrrol. Iodol.

Tetronal. Diethylsulphonediethylmethane. (Hypnotic.)

Thebaicum. Containing opium.

Therapol. Ozonized vegetable oils. (Ozone Co., New York.)

Theriaca. Molasses

Theriaca Andromachi. An aromatic astringent confection containing opium, which originally had more than 70 ingredients.

Thermine. Tetrahydrobetanaphthylamine. Tetrahydrobetanaphtholamine. (Heat producer.)

Thilanin. Compound of sulphur with lanolin. (Dermic.)

Thioform. Basic bismuth dithiosalicylate. (Antiseptic)

Thiolin. Salts of thiosulphonic acid. Salt of thiolinic acid. Sulphonated and sulphurated linseed oil.

Thiolo. Ammonium salt of thiosulphonic acid. Thiol. Artificial ichthyol

Thiosinamine. Allylsulphocarbamide; by the action of ammonia upon volatile oil of mustard. (Thorncliffe disinfectant.) See Izal.

Thymacetin. Oxethylacetamidothymol. (Analgetic.)

Thymolol. Aristol.

Tincal. Native borax.

Tinctura Hiera. Wine of aloes.

Japonica. Tincture of catechu.

Melampodii. Tincture of black hellebore.

Thebaica. Tincture of opium.

Tincture, Antacrid. Guaiac mixture with corrosive sublimate.

Antiperiodic. A kind of Swedish bitters with quinine.

Bestucheff's. Ethereal tincture of ferric chloride.

Huxham's. Compound tincture of cinchona with saffron.

Simulo. Tincture of the seeds of Capparis coriacea. (Nervine.)

Tolphite. A dusting-powder containing talcum. (England.)

Tolypyrin. A new antipyretic. Paratolyldimethylpyrazolone.

Tolysal. A compound of tolypyrin with salicylic acid.

Tongaline. Contains tonga, cimicifuga, colchicine salicylate, pilocarpine salicylate, according to Mellier Co., St. Louis.

Tonquinol. Trinitroisobutyltoluol. Substitute for musk.

Tous-les-mois. Canna starch.

Traumaticine. Solution of gutta-percha.

Treacle. Originally "Theriac." In English prescriptions it means "molasses."

Treacle, Venice. See Theriaca Andromachi.

Trefusia. A natural iron albuminate

Tribromhydrine. Allyl tribromide.

Trifolium Fibrinum. Menyanthes (Buckbean. Bogbean.)

Tri-Iodides, Henry's. For rheumatism. (Renz & Henry, St. Louis.)

Trimethylamine. Is not exactly the same as propylamine, though often prescribed thus.

Trional. Triethylsulphonmethylethylmethane. Diethylsulphonomethylethylmethane (Hypnotic.)

Trip. Iron subcarbonate.

Tritica. A kidney remedy. Probably a preparation of Triticum repens. (Searles & Hereth, Chicago.)

Trypsin. Peptonizing ferment of the pancreatic juice.

Tuberculocidin (shortened "T. C.," or Alexine "T. C."). Purified tuberculin, according to Klebs.

"E." Mixture of tuberculin (Koch) and tuberculocidin (Klebs), according to Spengler.

Tumenol. A preparation of tumenolsulphonic acid.

Powder. A similar preparation.

Turbeth Mineral. Yellow mercuric sulphate.

Turionis Pini. Pine cones.

Turlington's Balsam. Compound tincture of benzoin U. S. P.

"Turps." Oil of turpentine.

Tusche. India ink.

Tushy-stone. A gray zinc oxide.

Tutia. Impure zinc carbonate or oxide.

Tutty. Impure zinc oxide.

U.

Ultramarine. German blue.

Unction. Mild mercurial ointment.

Unguentum Ægyptiacum. Honey with acetate of copper.

Cerussæ Acetatæ (P. L. 1787). Cerate of lead acetate.

Diapompholygos. Ointment of impure zinc oxide.

Myrrhæ. Ointment basis · 1 part of myrrh and 10 parts of wax melted together with oil.

Nervinum. Compound ointment of rosemary

Ophthalmicum. A mild ointment of mercuric oxide.

Quercinum. Soft (moist) lead tannate.

Scytodepsicum. Moist lead tannate.

Uralin. Uralium.

Uralium. Chloral-urethan. Uralin.

Urethane. Ethyl-carbamate.

Uricedin-Stroschein. Compound, containing in 100 parts 27.5 sodium sulphate, 1.6 sodium chloride, 67 sodium citrate, and 1.9 lithium citrate.

Uropherin. Theobromine, lithium, and sodium salicylate. (Diuretic.)

V.

Valoid. Trade-mark for liquid extracts, etc. Burroughs, Wellcome & Co.

Valule. Trade-mark applied usually to capsules enclosing divided doses of substances. Burroughs, Wellcome & Co.

Vaporole. Trade-mark applied usually to capsules containing medicaments for inhalation, etc. Burroughs, Wellcome & Co., London.

Venus. Copper.

Crystals of. Copper acetate.

Vervain's Balsam. Compound tincture of benzoin.

Vienna Powder. Potassa with lime.

Vigoral. A mixture of beef extract and powdered beef. (Armour & Co., Chicago.)

Vin Mariani. Compound wine of coca. French specialty.

Vinegar of the Four Thieves. An aromatic vinegar of the French Pharmacopœia.

Vinolia Preparations. Contain zinc oxide and borax.

Vinum Adustum. Alcohol. (Sometimes brandy.)

Crematum. Brandy.

Virgin's Milk. A mixture of tincture of benzoin and water.

Viride Æris. Verdigris. (Crude copper acetate.)

Viscum Album. Mistletoe.

Vitriolum Cupri. Blue vitriol.

W.

Wade's Drops. Compound tincture of benzoin.

Wash Rag. Luffa ægyptiaca.

Goulard's. Lead water.

Waterglass. Sodium or potassium silicate.

White Copperas. Sulphate of zinc.

Flake. Lead carbonate.

Liquor. Southern negro term for alcohol.

"Nix." Crude zinc oxide.

Pearl. Bismuth subnitrate or chloride.

Permanent. Artificial barium carbonate or sulphate.

Wolfram. Tungsten.

Wolframate. Tungstate.

Wound Balsam. Compound tincture of benzoin.

Y.

Yellow Arsenic. Yellow arsenic sulphide.

Z.

Zea. Maize. Indian corn.

Zinc Flowers. Zinc oxide.

Zinchæmol. The same as hæmol.

Zootic Acid. Prussic acid.

Zooticum. As adjective to several salts Hydrocyanate.

Zymine. English name for pure pancreatin.

Z. Z. Anciently myrrh, now zingiber Ginger.

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